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REPORT
OF THE
PHILIPPINE
COMMISSION

PART 3

1906

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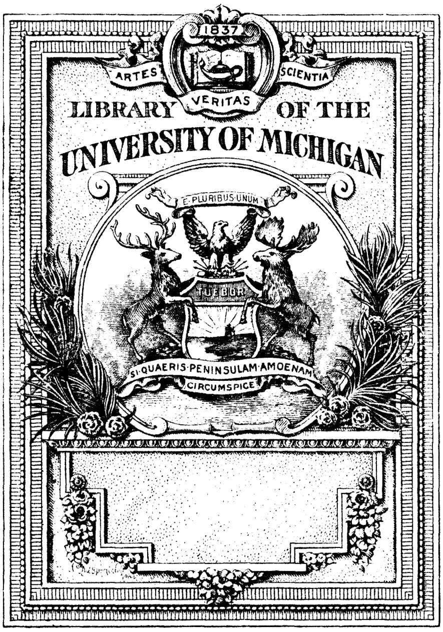

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SEVENTH ANNUAL REPORT

OF THE

PHILIPPINE COMMISSION.

1906.

(IN THREE PARTS.)

PART 3.

BUREAU OF INSULAR AFFAIRS : : WAR DEPARTMENT.

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REPORT OF THE SECRETARY OF FINANCE AND JUSTICE.

REPORT OF THE SECRETARY OF FINANCE AND JUSTICE.

DEPARTMENT OF FINANCE AND JUSTICE,
Manila, September 1, 1906.

GENTLEMEN: I have the honor to submit a report on matters, legislative and executive, pertaining to the department of finance and justice in the Philippine Islands during the fiscal year 1906. Reports from this office have heretofore covered not only the fiscal year, but some months subsequent thereto, for the purpose of bringing the reports down to as late a date as practicable. The governor-general having directed that hereafter reports shall cover fiscal years only, this report and subsequent ones will be made accordingly.

ADMINISTRATION OF JUSTICE.

The work of the higher courts throughout the islands has been satisfactorily carried on during the year, regular terms being held in all cases at the times and places fixed by law, and special terms at such times and places as might best promote the interests of justice and the convenience of litigants.

The amount of criminal business continues to be, as heretofore, largely in excess of the civil litigation. It is believed, however, that after the present year the amount of criminal business will materially diminish, owing to the prevalence of good order throughout the islands and the almost total extinction of ladronism from the great island of Luzon.

The supreme court is still largely in arrears in its work. There were pending in that court June 30, 1906, 425 civil and 482 criminal cases, making 907 cases then undisposed of. During the year the court disposed of about 550 cases, so that it is apparently nearly two years in arrears. It should, however, be remarked that many of the cases undisposed of have been heard and are only awaiting decision. Many others are old cases that probably never will be heard, but will ultimately be otherwise disposed of.

There were pending in the courts of first instance in the city of Manila at the close of the fiscal year 918 cases, civil, criminal, and customs appeals, 125 of which were criminal cases, the practice having been to dispose of criminal cases in preference to civil ones, so as to avoid the long confinement of prisoners awaiting trial. Many of the civil cases are matters of administration and are awaiting the closing of estates. These courts have not kept abreast of the business during the year, there being at the end of the year 213 more civil cases and one more criminal case than on June 30, 1905.

In all the courts of first instance of the islands, outside of the city of Manila, there were pending at the end of the fiscal year 2,555 civil and 1,271 criminal cases. During the year the courts disposed of, by decision or dismissal, 1,995 civil and 4,202 criminal cases.

The court fees collected in the supreme court during the year amounted to ₱10,157.43; the fees, costs, and fines imposed in the courts of first instance during the year amounted to ₱198,599.20, and the fees in the court of land registration to ₱39,914.78. The amount collected for fees, fines, and costs in the courts of first instance during the year is very largely in excess of that collected in prior years, due to the fact that during the past year the clerks of courts, under administrative orders, have been much more diligent in the collection of the costs imposed, and the above statement includes, more or less, costs imposed during previous years and collected during the past year. These figures include the sums collected in the city of Manila.

There has been some complaint that native attorneys have not yet adjusted themselves to the method of preparing cases for transmittal to the supreme court by bills of exception, as provided in the code of civil procedure, and the secretary of finance and justice has requested the judges of the supreme court to make suggestions as to amendments of existing law in regard to methods of carrying cases from courts of first instance to the supreme court should the judges be able to recommend any system that would be more simple and easily understood than the present one. The present code has been in operation for nearly five years, and experience has enabled the judges of the supreme court to determine whether any amendments in the respect referred to are desirable. Up to the present time no proposed amendments, agreed to by all the judges, have become available, and it is doubtful whether, in view of the decisions that have already been made on the subject of bills of exception, and the greatly increased facility of Filipino lawyers in adapting themselves to the provisions of the law have not rendered changes of the law undesirable. No recommendation upon that subject is made at this time, as it is deemed undesirable to change the procedure which has become fairly well understood unless the judges of the supreme court, after five years' experience, are able with substantial unanimity to suggest amendments.

The work of the supreme court could be largely diminished by surrounding appeals to it with more rigid requirements, but inasmuch as questions of fact in the courts of first instance and other courts of analogous grade are determined by a single judge, without the intervention of a jury, it has from the beginning been deemed wise to make the entrance to the supreme court by way of appeal fairly easy, so that important questions of fact can not be determined finally by a single judge. Under the present system it is not difficult to secure revision of questions of fact as well as of law by the supreme court, whereby the judgment of seven trained lawyers is invoked to review the findings of a single judge with much more liberality than ordinarily prevails in the United States. This liberality is necessary, because a question of fact in the courts of the United States would ordinarily be determined by a jury. The system existing in the islands in this respect follows the former procedure under Spanish régime, and it is believed there is little danger that an error can intervene when all the questions of a case may be finally reviewed by seven eminent judges. I think it is practically the unanimous judgment of all who are familiar with the local situation that the prevailing system is far better adapted to conditions existing in the islands at the present time than would be any system that could be devised involving introduction of jury trials.

THE JUSTICE OF THE PEACE SYSTEM.

As was stated in the last report from this office, the justice of the peace system has been subject to great criticism, mainly because of the abuse of power by justices of the peace and the absence of any direct, efficient control over them. After very full consideration and conference with the judges of the supreme court and other judges and lawyers the justice of the peace system was materially changed by act No. 1450, passed February 3, 1906. Since the enactment of that law few, if any, complaints have come to this office in regard to oppression by justices. Under this law appointments of justices of the peace are made for a period of two years, from lists furnished to the governor-general by the judge of the court of first instance of each judicial district. The judge of the court of first instance is also given supervision over justices within his district, and it is made his duty to call a meeting of the justices in each province at the provincial capital at least once a year for the purpose of discussing questions relating to the administration of their office and of instructing them in the performance of their duties. In case of complaint against a justice it is the duty of the judge to investigate the grounds of complaint and report to the governor-general for such action as to him may seem fit. The act also greatly simplifies the procedure in justice courts, a reform that was most necessary, and makes it practicable for a man of good judgment and sense to perform the duties of the office without unreasonable burden and in a satisfactory manner. The fees were also increased, so that the best men in each community can afford to accept appointment. One abuse that had formerly existed was for justices to issue warrants of arrest for defendants residing in remote provinces, and to cause them to be arrested and brought to the municipality in which the justice presided. This was an instrument of oppression, often used for the purpose of revenge. The act referred to prohibits the execution of a warrant for arrest, issued by a justice of the peace, of persons residing in other provinces unless the order of arrest be indorsed by a judge of a court of first instance or, in his absence, by the prosecuting attorney, certifying that, in his opinion, the interests of justice require that such warrant or process be served or executed anywhere in the Philippine Islands or within certain designated territory, as the case may be.

The present law is believed to be the best that is practicable for the present, for the justice of the peace system in the islands, and meets the approval of substantially all who have given study to the question. The judges of the courts of first instance are devoting themselves diligently to promoting the efficiency of the justice courts over which they have supervision, and to instructing the justices in the proper manner of performing their duties. The mere fact that the justices are brought into immediate contact with the judges of the courts of first instance and know that they are being supervised by those higher officials is a potent factor in securing a more just and honest performance of their duties.

COURT OF LAND REGISTRATION.

The work of this court has gradually become more and more important. It has now been in operation something less than three and one-half years, and its business during the past year has been steadily increasing. Up to September 1, 1905, the total number of applications for registration of titles through the court of land registration was 1,653, while the total number at the end of the fiscal year, June 30, 1906, was 2,467, making 814 applications received during the last ten months, or an average of 81 cases a month. The increase is due to the facts that a knowledge of the land registration court is becoming more general, that on lands set apart as military and civil reservations it has been obligatory on the people residing thereon to register their titles, that the registers of deeds have been more vigorous in explaining the law to the people in the provinces and in assisting them in the preparation of their applications for presentation to the court, and that the sessions of the court have been more numerous, being held, to the great encouragement of the property owners, in nearly every province. The 814 applications filed during the last ten months of the fiscal year came from 33 provinces, representing nearly every province in the islands. The value of the property represented in the applications within this short period amounted to nearly ₱10,000,000, and the value covered by all applications made since the organization of the court amounts to about ₱30,000,000. This is undoubtedly a more rapid progress in the acceptability of the system of registration, called the "Torrens system," than has been shown in any other country during the earlier years of its inauguration. Some of the applications presented cover immense estates, occupied in several instances by thousands of people. There are at present pending in that court 1,058 cases, many of which have been in great part heard, but final determination of which awaits amendments to petitions, furnishing of plans, and further evidence.

The attention of the people has been more generally called during the past year than before to the liberal provisions of the public-land act, No. 926, which authorizes persons who have occupied and cultivated lands for a period of ten years to secure titles to the same through the land-registration court. This provision is being availed of more and more and accounts in part for the increase in the number of applications during the past year. The work of this court is so important and lies so largely at the foundation of such real prosperity as can result only from good titles that the increase of applications is a very encouraging indication. The work is increasing so rapidly that the number of judges available for use in this court ought now or in the immediate future to be increased.

CRIMINAL CODE AND CODE OF CRIMINAL PROCEDURE.

Owing to the retirement of Governor-General Wright and the absence on long leave of Vice-Governor Smith, there has been on the Commission during a considerable portion of the year but one lawyer, and it has been deemed undesirable to complete and enact a criminal code and a code of criminal procedure with but one lawyer in that body, and this important legislation still awaits enactment.

CHANGES IN THE PERSONNEL OF THE COURTS.

Hon. John C. Sweeney, judge of the court of first instance, city of Manila, resigned on March 29, 1906, and the vacancy thus created was filled by the promotion of Hon. Charles S. Lobingier, judge of the twelfth judicial district, and the vacancy thus caused in the twelfth judicial district was filled by the promotion of Hon. William F. Norris, judge of the fifteenth judicial district, and the vacancy thus created in the fifteenth judicial district was filled by the appointment of Hon. José C. Abreu.

Judge Abreu, who, prior to this appointment, was assistant prosecuting attorney of the city of Manila, has received a thorough legal education, not only in the Philippine Islands, but likewise in the United States. He speaks English and Spanish with equal fluency and has the great advantage of a thorough knowledge of both Spanish and American jurisprudence.

There was a vacancy in the thirteenth judicial district, caused by the death of Hon. Warren H. Ickis, which was announced in the last report from this office. The vacancy was filled on March 26, 1906, by the promotion of Hon. Ramon Avanceña, who was a judge at large prior to this appointment, and the vacancy in the position of judge at large thus caused was filled by the appointment of Hon. Charles H. Smith, effective March 26, 1906. Prior to this appointment Judge Smith had held the office of prosecuting attorney for the city of Manila for three or more years. On the 22d day of May, 1906, Hon. Newton W. Gilbert, of Indiana, a Member of the Congress of the United States and of the Taft party which visited the islands in August, 1905, was appointed judge at large. The appointment of Judge Gilbert is the only one made during the year from persons outside the service in the Philippine Islands and was undoubtedly warranted by the distinguished character and ability of Judge Gilbert.

DESTRUCTION OF COURT BUILDING AT TARLAC.

On March 19, 1906, a disastrous fire occurred in the town of Tarlac, the capital of the province of the same name, in the fourth judicial district, which destroyed the provincial building, including the rooms occupied by the court and the court officials. All the court records of that province, as well as documents belonging to other provinces in the same judicial district, which the judge at the time had with him at Tarlac, and the records of the provincial fiscal were destroyed. Every effort has been made to reproduce the records, and by the most industrious application on the part of Judge Llorente, presiding in that court, the work of the court is again in fairly good condition and proceeding in regular order. A new and substantial fireproof provincial building is now in process of erection at Tarlac.

ATTORNEY-GENERAL'S OFFICE.

The report of the attorney-general, giving a detailed statement of the work of the bureau of justice, is hereto annexed and marked "Exhibit No. 1."

The Hon. Libbeus R. Wilfley, who had been attorney-general of the Philippine Islands since the organization of the bureau of justice, resigned on the 16th day of July, 1906, to accept an appointment as United States district judge for China under recent Congressional legislation, and was immediately succeeded by Hon. Gregorio Araneta, who had been solicitor-general since the organization of the bureau and who was the natural successor of the attorney-general, not merely by reason of his position, but also by reason of demonstrated capacity and fitness. Judge Wilfley's services have been important and valuable during the whole formative period of the Philippine judiciary, and he is to be congratulated upon the promotion which has come to him. Owing to the departure of Judge Wilfley, the report of the attorney-general has necessarily been prepared by his successor, Attorney-General Araneta.

Three hundred and forty-three opinions have been prepared by the attorney-general during the year for the aid of the chief executive, heads of departments, chiefs of bureaus, and other officials. In 385 cases in the supreme court briefs and arguments have been presented, and in 67 cases the attorney-general's office has intervened in motions and for other purposes. In 165 cases this office has intervened in cases pending in the court of land registration for the protection of the public interests, and 227 additional cases in that court have been investigated by the attorney-general's office, but no opposition was interposed because the public interests did not appear to be affected. Four thousand three hundred and seventy-four official communications have been written and received requiring the attention of the office, aside from opinions, appearances in court, investigating pardons, and attention given to appointments.

In addition to this the work of administering the estates of deceased employees of the government was transferred, by act No. 1407, from the bureau of the treasury to the bureau of justice, but the latter bureau did not take charge of this work until December 1, 1905. During the year 46 estates of deceased employees have been administered and there are now 57 pending settlement. These estates are all small and the law provides a brief and inexpensive method of administering estates of deceased employees so as to save the expense of regular administration.

INSULAR COLD STORAGE AND ICE PLANT.

By the reorganization act, No. 1407, the administration of the insular cold storage and ice plant was transferred from the department of finance and justice to that of public instruction, and the report concerning that bureau will therefore be made by the secretary of public instruction.

COINAGE AND CURRENCY.

As stated in former reports from this office, the work of eliminating the old currency has been practically completed. Small sums have been exported from month to month or purchased at the insular treasury, representing, probably, small hoards that had been buried and had now been brought to light in view of the fact that there is no opportunity to hold them longer with a prospect of speculative profit.

The various steps that have been taken during the year in connection with coinage and currency may be briefly summarized as follows:

1. *Certificate of indebtedness.*—Under the authority of an act of Congress, certificates of indebtedness had been issued for the purchase of silver for the new coinage and for the establishment of a fund for the maintenance of the currency on a parity with gold, aggregating $6,000,000. As the new system became more thoroughly established the amount of these certificates was gradually reduced, and on September 1, 1905, a new series of $1,500,000 was issued in the place of the larger sum before outstanding. The certificates were issued for one year only and the Commission has determined that after September 1, 1906, the amount of indebtedness may safely be reduced $500,000 more, so that the new series of certificates will be for but $1,000,000, and that sum represents the whole indebtedness on account of the gold standard fund. The certificates have all been sold at such a rate that, while the proceeds remained on deposit as a safety fund drawing interest, the interest received has been greater than the interest actually paid out on the certificates. To anticipate somewhat the period covered by this report, it may be stated now that the new series of certificates of indebtedness for $1,000,000 has already been sold in New York at a premium of $2.28, leaving a net interest to be paid, as the certificates run for but one year, of but $1.72.

2. *Seigniorage and cost of new currency.*—Up to and including June 30, 1906, there had been shipped to the mint at San Francisco for the purpose of recoinage the sum of Pfs. 16,458,507 (Spanish-Filipino coins), which would yield on the basis of that already reported from the mint, approximately ₱14,783,249 (Philippine currency). The recoinage of the Spanish-Filipino coins has resulted in a loss to the Treasury of approximately ₱28,430, including loss on copper coins purchased. After deducting the profit which has been made on Chinese, Mexican, and other foreign coins sold by the Treasury for the purpose of export, the net seigniorage profit down to the end of the fiscal year on the entire process of coinage and recoinage will be approximately ₱2,691,911.

3. *Additional currency received.*—The total amount of new coinage of all denominations in the islands down to June 30, 1906, amounted to ₱33,685,501.80, of which ₱30,030,411.60 were in actual circulation, including in this latter statement such pesos as were represented in actual circulation by silver certificates. The amount of new coinage received in the islands during the fiscal year was ₱1,723,351.24, and the increase in circulation was ₱1,869,744.66.

4. *Increased use of silver certificates.*—The amount of silver certificates in circulation June 30, 1905, was ₱10,450,000, and on June 30, 1906, ₱14,410,000, making an increase of ₱3,960,000 during the fiscal year.

Under the authority of Congress new certificates have been prepared of denominations of ₱20, ₱50, ₱100, and ₱500 each, which will prove a very great convenience to large business interests and will cause a decided increase in the amount of silver certificates in circulation.

5. *Continued use of the gold-standard fund in the way of exchange.*—During the year exchange on the gold-standard fund deposited in New York was sold by the treasurer by telegraphic transfers or demand drafts to the amount of $7,454,860.98, from which a premium of $68,295.67 was realized and credited to the gold-standard fund. No drafts were sold in New York upon the gold-standard fund in Manila during the year, notwithstanding the low rates of three-eighths of 1 per cent for telegraphic transfers and three-quarters of 1 per cent for demand drafts which were authorized. On March 15, 1906, the price of telegraphic transfers was, by order of the secretary of finance and justice under authority of law, reduced from one and one-eighth to three-quarters of 1 per cent, the same as for demand drafts. The order was made to meet a special emergency in order to stimulate the sale of telegraphic transfers and thereby bring into the treasury additional pesos for use in the islands, which were badly needed, and to enable the treasury to meet the requests of the Treasury of the United States for placing to its credit in the Philippine Islands large sums which it desired to disburse here and in return for which like sums would be deposited to the credit of the insular treasury in its depositories in New York. By the action of the transfers last referred to the gold-standard fund had become undesirably depleted in the islands and accumulated in New York. By the reduction of the rates for telegraphic transfers the sale of such transfers was undoubtedly somewhat stimulated for the time being and the special emergency was met. But this is deemed to be an undesirable expedient. It is better that the rates should remain, in general, stable and fixed in the islands so that bankers and business men may shape their business accordingly.

6. *Exchanges at the treasury.*—$4,012,206.63 United States money were exchanged at the treasury for double that number of Philippine pesos, and ₱25,259,729.34 were exchanged for half that number of United States dollars, thus furnishing to the public a convenient means of interchanging the two currencies without cost and of establishing in the minds of all complete confidence in a currency which is exchangeable at all times for a strictly gold-standard money like that of the United States.

7. *New legislation relating to recoinage and to deposits as security for silver certificates.*—In the last report from this office attention was called to the great rise in the price of silver in the world's markets and to the difficulty of increasing the coinage circulation of the islands without purchase at a loss of silver bullion for coinage and to the great burden that was being gradually imposed upon the insular government in providing storage for Philippine pesos placed on deposit as security for the silver certificates issued and put into cir-

culation and the need of more pesos for actual circulation. In that report reasons were fully stated why Congress should be asked to authorize the placing of gold coin of the United States in reserve in the treasury in support of the silver certificates instead of Philippine pesos, whereby a large number of pesos would be released for circulation and the security of the certificates would be in no way impaired and the vault space necessary for the constantly increasing supply of pesos would not require immediate enlargement. It was recommended to the Commission and by the Commission recommended to the Secretary of War that Congress authorize the Philippine government to use gold coin in part as a reserve for the silver certificates, such gold coin being full legal-tender money in the Philippine Islands. It is unnecessary here to repeat the arguments that were produced in the former report in support of this proposition. The Commission adopted the recommendations therein contained and requested the Secretary of War to obtain, if practicable, the necessary legislation by Congress. It was also recommended that authority be given to deposit in banks at New York the gold coin so held in reserve and that the gold-standard fund receive the benefit of the interest that would accrue thereon. Owing to the greatly increasing price of silver, which, in May, 1906, rose to 31⅜d. per ounce for standard silver in London, the cost of the Philippine peso laid down in Manila, including the purchase price of the silver, interest, transportation, coinage, and other expenses, would be ₱1.10548 and the existing coins were exposed to the danger of melting or exporting, the intrinsic value being more than 7 per cent greater than the face value. To meet the emergency temporarily the Commission passed act No. 1411, prohibiting the exportation of Philippine pesos or bullion produced therefrom. It is believed that no Philippine pesos have been exported in the face of the prohibitions of the act referred to and the heavy penalties therein provided, but the danger would be a constantly existing one. To meet these difficulties Congress, on June 23, 1906, passed an act entitled "An act to amend an act approved March second, nineteen hundred and three, entitled 'An act to establish a standard of value and to provide for a coinage system in the Philippine Islands,'" by virtue of which authority was given to deposit gold coin of the United States in the Philippine treasury as a reserve for certificates which should be hereafter issued, and also authorized the recoinage of the existing pesos, or the coinage of additional ones from silver purchased, on the basis of not less than 700 fine silver in 1,000 parts.

This legislation by Congress is most important and furnishes an immediate relief from the situation which had become most strained by the shortage of circulating medium and the high price of silver, which rendered it impracticable to purchase additional bullion for coinage. The authorized new coinage would float side by side with the old, as the coins would probably be of the same size and appearance and would differ only in the amount of silver and alloy, respectively, therein contained, and would involve no financial disturbance whatever, as a sufficient amount of the old coins would come into the treasury from month to month to enable the currency to be rapidly shifted from one standard to the other. The result of the recoinage would be an addition of several million pesos to the circulation in the islands by reason of the increased value of the silver contained in the existing pesos, while the new pesos would have a greater intrinsic value of silver at present prices than did the existing coins at the time of their coinage. Even if the new coinage should be on a basis of 700 fine, which is the lowest limit authorized by the act of Congress, the present coinage being on a basis of 900, still the new coins would have a much larger proportional intrinsic value than the silver coins in circulation in the United States, Great Britain, Germany, France, Italy, or any other of the great commercial nations. But the stability of the coins depends upon their fixed relation to the gold standard, and that would not be in the slightest degree affected by the new coinage. The ratio to be employed in the new coinage has not yet been determined, but is under consideration.

The provision authorizing the partial substitution of United States gold coin instead of pesos as a reserve for the silver certificates has already been availed of to the extent of $750,000 gold, old certificates to the amount of ₱1,500,000 having been withdrawn, and new ones to the same amount having been issued, based upon the gold deposits in accordance with the act of Congress. This transaction has resulted in the release of ₱1,500,000 of silver currency for circulation in the islands and has greatly relieved the situation for the time being. The amount to which the substitution of gold in place of silver as a reserve for the certificates is fixed by the act of Congress at not exceeding 60 per cent of the total issue.

BANKS AND BANKING.

No new banks have been organized in the Philippine Islands during the year. A small bank of ₱50,000 nominal capital, organized during the fiscal year 1905 at Dagupan, province of Pangasinan, was closed during the year. It was ascertained that the funds of the municipalities were being utilized as the real basis of the business of the bank under the authorization of the provincial treasurer, a proceeding not authorized by law. Demand was made upon the bank to return to the municipalities the sums which they had deposited therein so that they might be placed in the depositaries authorized by law. The bank was unable to comply with the demand, and steps were taken to cause it to liquidate. The depositors were all paid, and the assets of the bank are such that the stockholders probably will sustain little loss. The whole basis of the structure rested upon deposits of public funds in violation of law, which would most certainly have resulted ultimately in material loss to the public.

At the close of the fiscal year the funds of the treasury not kept in New York and not retained in the vaults were deposited in the Philippine Islands in depositaries authorized by law as follows: In the International Banking Corporation, ₱171,646.52; Chartered Bank of India, Australia, and China, ₱98,478.14; Hongkong and Shanghai Banking Corporation, ₱136,295.11.

The status of the Spanish-Filipino Bank remains as at the time of the fourth annual report of this office. It is still believed that it is greatly to the interest of that institution that its charter should be so amended as to be brought into harmony with American banking principles. On the 13th day of December, 1905, this office recommended by cablegram to the Secretary of War that that bank be made an authorized depositary for funds of the government of the Philippine Islands, upon giving proper security. Such action, however, has not been taken, no reply having been received from the Secretary of War.

Reference was made in the fourth annual report to the closing of the so-called American Bank. The assets of the bank have been liquidated and dividends paid to the depositors amounting to 45 per cent in the aggregate. Few assets remain unadministered. The cashier, H. B. Mulford, was prosecuted for embezzlement in the court of first instance of the city of Manila, was convicted on December 16, 1905, and sentenced to six years' imprisonment with a fine of ₱6,000. His cases are now pending in the supreme court of the Philippine Islands on appeal.

AGRICULTURAL BANKS.

There was a full discussion in the last report of this office on the subject of agricultural banks in the Philippine Islands, and a recommendation was made that Congress be asked to authorize the establishment of an agricultural bank with private capital, the principal of which should be guaranteed by the government of the Philippine Islands and interest not exceeding 4 per cent per annum, with a limitation that the sum which the government of the Philippine Islands should be called upon to pay in any one year should not exceed $200,000, and that the rate of interest allowed to be charged to borrowers should not in any case exceed 10 per cent, the difference between the rate guaranteed by the government and the rate at which loans could be made being considered as probably sufficient to pay the expenses of operation under rigid governmental supervision and likewise to pay a sufficient per cent to investors to attract private capital. This recommendation was substantially in line with the plan of the Egyptian agricultural bank. The recommendation from this office was concurred in by the Commission and the Secretary of War gave his approval to the substance of the whole scheme, and the bill was introduced in Congress authorizing the establishment of an agricultural bank or banks in the Philippine Islands substantially upon the lines recommended and making the limitation of the total amount which the government of the Philippine Islands could be called upon to pay in any one year $500,000 instead of $200,000 as recommended.

Owing to the urgent press of other important business the bill was not acted upon at the session of Congress recently closed, but it is hoped that it may receive favorable action at the coming session.

It is recommended that the Philippine Commission in its annual report again renew its former recommendation in this behalf.

POSTAL SAVINGS BANK.

In the fourth annual report of this office the great probable utility of the establishment of postal savings banks in the Philippine Islands was set forth and it was stated that a draft of a law for the establishment of such banks throughout the islands had been prepared and would be submitted to the Commission at an early date and its passage recommended. On the 24th day of May, 1906, act No. 1493 was passed creating such an institution and placing it under the administration of the bureau of posts and, therefore, of the secretary of commerce and police, whose report doubtless will cover the details of this subject.

CUSTOMS SERVICE.

The insular government still depends very largely upon the customs service for its revenues, but the bureau of internal revenue is supplying the deficit caused by the reduction in customs receipts and must more and more be depended upon by the government for its support.

NEW LEGISLATION AFFECTING THE CUSTOMS.

Diminished appropriations for the customs bureau have necessitated economies in various directions and the abolition of more or less positions previously authorized. Special agents of the bureau of customs who had heretofore been engaged in the work of examining the different custom-houses and of giving instructions to collectors of customs and their subordinates were abolished by appropriation act (No. 1416) for the fiscal year, as no provision for salaries of such officials was made, and their duties by the reorganization act were transferred to the corps of district auditors created under the accounting act, No. 1402.

By act No. 1309, passed September 5, 1905, a material reduction in the marine-license tax was made. While the reduction diminished the revenues, it tended to the relief of the shipping interests throughout the islands, which were in a somewhat depressed condition.

By the reorganization act (No. 1407) several positions in the customs service were abolished and the duties appertaining to those positions were imposed upon other officials or employees.

The prohibition of the exportation of the Philippine silver coins or bullion made from such coins, by act No. 1411 has been heretofore referred to. The enforcement of this act devolved upon the customs service. No attempted violations of the law have been discovered.

By act No. 1432 the net income arising from the operation of the Arrastre plant on the wharf at Jolo was transferred to the government of the Moro Province.

By act No. 1461 the bureau of customs was required to cooperate with the bureau of internal revenue in the control of the opium traffic in the Philippine Islands and in the collection of the heavy tax thereby imposed upon that traffic. This increased tax undoubtedly explains in part the decrease in opium importations, which will be hereafter referred to in connection with the bureau of internal revenue.

On February 26, 1906, Congress amended paragraphs 117, 118, 119, 120, and 123 of the cotton schedule, paragraphs 223 and 225 of the shoe schedule, and paragraph 402 relating to export duties of the tariff revision law of 1905. The apparent intention of a portion of this legislation was to make it difficult for English, German, and other foreign manufacturers of cotton goods to retain possession of the Philippine market with their commodities and to transfer that trade to manufacturers in the United States. The act, by its terms, went into effect very soon after its enactment and before its perfected promulgation in the Philippine Islands. The consequence was that many importers of English and German cotton goods who had placed contracts for large quantities of fabrics found themselves obliged to pay very heavy duties upon the arrival of their goods in the Philippine Islands and suffered heavy losses, as they claimed, by reason thereof. They were not able seasonably to countermand orders placed because of want of sufficiently early information as to the enactment of the legislation referred to. Several complaints in writing and requests for compensation have been made in behalf of such importers residing in Manila, and their communications have been forwarded to the Secretary of War. There is a certain equity in their claims which probably ought in some way to be recognized. It has also been charged that the result of this legislation is largely to increase the cost of cotton goods to natives of the Philippine Islands for the benefit of American manufacturers. A careful investigation upon this subject has been made by my direction by the insular collector of customs.

TONNAGE DUES.

Congress has given to the Commission power to abolish all tonnage dues upon vessels coming from foreign ports to the Philippine Islands should it be deemed wise so to do. The collections under this head for the calendar years 1902 to 1905, inclusive, are as follows:

Calendar year 1902	₱122, 218. 42
Calendar year 1903	140, 116. 48
Calendar year 1904	141, 282. 72
Calendar year 1905	125, 175. 76

The question as to whether this source of revenue ought to be entirely eliminated is one for the early consideration of the Commission. It is manifestly true that any imposition in the way of taxation upon shipping is in a sense a burden upon commerce, but that is true of taxation of every kind, practically. The big shipping companies who make use of the harbor facilities of the Philippine Islands and its light-house service, which are constructed and maintained at an enormous expense to the government, perhaps might fairly well bear some small portion of the burden which rests upon every other industry. The land tax and internal-revenue tax are both taxes upon industry. If the tonnage dues were abolished, shipping would then be subject to the tax of one-third of 1 per cent upon its earnings under the provisions of the internal-revenue law, that tax not being collectible upon ships that pay tonnage dues. It has been said that the other Asiatic ports are free from such charges, therefore more favorable to shipping. It appears, however, upon investigation that this statement is not entirely correct. At Singapore and Hongkong light charges are exacted of incoming vessels, and at Shanghai the harbor dues, including light dues, are about two and a half times what they are in Manila, but commerce thrives abundantly at that port. If any of the companies maintaining service between the United States and the Asiatic coast would, in consideration of the abolition of harbor dues, agree to bring their ships directly to Manila instead of requiring transshipment at Hongkong, the added facilities would abundantly warrant the Government in abolishing the tonnage dues. This subject is now pending before the Commission on a recommendation of the committee appointed under executive order No. 12, series 1905, which has reported in favor of the abolition of these dues. It should be remarked that the coastwise trade, which has needed very great encouragement, has been relieved by acts Nos. 1341 and 1354 of licenses and clearance fees.

PORTS OF JURATA AND SITANKI.

The establishment of these ports was mainly for the purpose of interfering with illicit trade between the southern islands and the neighboring ports on the island of Borneo. The collections at these ports are small, as was expected, but their effect as deterrents upon smugglers is considered to be very satisfactory and valuable.

CUSTOMS RECEIPTS.

The total customs collections for the fiscal year for the entire archipelago aggregated ₱15,106,181.90, a decrease of ₱1,420,706.60, or 8⅗ per cent as compared with the previous fiscal year, when the aggregate collections were ₱16,526,888.50. The total customs collections for the fiscal year 1905 were ₱340,848.02 less than for the fiscal year 1904.

For the fiscal year 1906 the total customs expenditures were ₱878,206.46, while like expenditures for the fiscal year 1905 were ₱1,040,557.74, a reduction of 15⅘ per cent in favor of the last fiscal year, and a reduction of 22¼ per cent as compared with the fiscal year 1904.

The total customs collections, however, included the refundable export duties paid on hemp shipped to the United States, and this amount for the last fiscal year was ₱827,914.70. The very marked reduction in customs receipts for the fiscal year 1906 as compared with the two preceding years is accounted for in large part, though not wholly, by the reduction of imports of three items—opium, rice, and materials for street railway equipment—and by the decreased collection of export duty on hemp. The decrease in value of the opium imported was nearly 50 per cent, and in quantity more than 40 per cent, making a decrease in total customs receipts from this source of ₱187,876, notwithstanding the higher rate of duty now imposed upon opium as compared with former years.

The reduction in the importation of rice has been most marked. In the fiscal year 1904 ₱23,097,628 went out of the islands to pay for imported rice, in 1905 ₱14,913,476, and in 1906 ₱8,743,964. The decrease in customs receipts on rice for the fiscal year 1906 as compared with the preceding year was ₱527,960.

During the fiscal year 1905 the Manila Electric Railway and Light Company imported materials and supplies upon which a large amount of duties was collected. During the last fiscal year that work has required far less importations, and the reduction in import revenues from this source amounted to ₱130,000.

These three items aggregated ₱843,836 of the total reduction in customs receipts.

There has also been a reduction in the amount paid by the government for imports during the past year as compared with the prior year, which, of course, does not affect the real financial status of the government.

There was also a reduction of something over ₱80,000 in the amount of annual license fees of vessels and from the abolition of clearance charges for interisland service.

The occasion for the great reduction in customs collections upon opium undoubtedly is the operation of the opium law passed March 8, 1906.

Doubtless considerable stocks of opium had been imported and secreted before the passage of the law, and the very heavy burdens placed upon the traffic under the opium act have rendered smuggling so profitable that the temptation is irresistible. There is further reference to this subject in connection with the report of the collector of internal revenue.

The reduction in revenue from the importation of rice is a remarkably good indication of returning prosperity of the islands, arising from increased production of that commodity, owing in part to the gradual restocking of the country with draft animals, mainly by the processes of nature, importations for that purpose not having been specially successful. Doubtless some of the reduction in the importation of rice may be due to diminished purchasing power on the part of the people, particularly in the hemp-producing regions, which were seriously affected by the typhoon of September 26, 1905, whereby those provinces, which are, on the whole, the richest of any in the islands, were deprived in part of their means for purchasing rice by the destruction of their hemp plants. In the hemp provinces very little rice is raised, and the inhabitants depend upon rice imported from Saigon or from other parts of the Philippine Islands; but the evidence from the reports of governors of the different provinces is conclusive that a much larger area is being devoted to the culture of rice each succeeding year for the last three years.

The customs collections at Iloilo show a substantial increase for the last year as compared with the year immediately preceding, but are less than those for the fiscal year 1904.

In Cebu there has been a marked reduction during the fiscal year 1906, amounting to ₱277,150.28, as compared with the preceding year. The island of Cebu has suffered during the past year from a very severe drought, which seriously affected the purchasing power of the people.

The port of Zamboanga shows a steady increase for three fiscal years, the total receipts there being as follows:

Fiscal year 1904	₱82, 240. 40
Fiscal year 1905	108, 719. 86
Fiscal year 1906	178, 818. 96

There is no reason to believe that the increase in business at the port of Zamboanga will not continue.

The port of Jolo shows a decrease in collections for the past year of about 11 per cent.

EXPORTS.

The total value of all exports from the islands for the fiscal year was ₱63,836,760, a decrease of ₱874,970, as compared with the preceding year. The decreases are in hemp and sugar, while there was an increase in the exports of copra and tobacco, hemp alone showing a loss of ₱5,398,944, and sugar an additional loss of ₱226,322, while copra shows an increase of ₱3,897,386, and tobacco, ₱787,704.

The value of the total exports of sugar for the year was ₱9,727,730, of which ₱520,208 went to the United States. Practically no market, therefore, for Philippine sugar in the United States has been found during the past year.

The total value of exports of tobacco products during the year was ₱4,779,780, of which the United States received but ₱62,006.

BALANCE OF TRADE.

During the fiscal year 1906 the total value of imports was ₱51,597,704 and the exports ₱63,836,760, showing a balance in favor of the islands of ₱12,239,056, which is nearly ₱8,000,000 more than the record for any previous year. Had it not been for the destructive typhoon which materially diminished the exports of hemp the showing would have been probably ₱4,000,000 more favorable. Currency is excluded in statements of both imports and exports. During the whole period of American occupation the total imports into the Philippine Islands have amounted to ₱437,802,312 and of exports ₱419,758,814, showing for the whole period an excess of ₱18,043,898 of imports over exports.

TRADE WITH THE UNITED STATES.

The total value of imports for the fiscal year 1906 from the United States was ₱8,666,040, a decrease of ₱3,012,984 from the corresponding preceding year. The total value of Philippine products exported to the United States was ₱23,160,338, a decrease of ₱8,197,412, as compared with the corresponding preceding year.

While there has been a loss in the total of both the exports and imports, the United States has sustained a greater loss, relatively, than other countries from which Philippine imports are received and to which Philippine products go.

The use of flour in the Philippine Islands is increasing, but the total value of importations of this commodity from the United States during the last fiscal year was ₱892,154, showing a loss of ₱335,820, as compared with the year immediately preceding. This reduction may probably be attributed mainly to the prevalence of the boycott among the Chinese, the principal retailers in flour in the Philippine Islands.

The value of the importation of cotton goods from the United States during the last fiscal year was ₱557,592, showing a decrease of ₱970,584 from the value of the importations of the preceding year, or a loss of two-thirds, notwithstanding the fact that there has been an increase in the total imports of cotton goods during the same period. This reduction can doubtless, in considerable part, be also attributed to the Chinese boycott.

UNNECESSARY IMPORTATIONS.

It is doubtless true that many articles are imported into the Philippine Islands which ought to be produced here in sufficient quantities for the whole of the local consumption. Among these articles may be mentioned rice, to which reference has before been made; cattle (during the last fiscal year cattle, mainly for beef, were imported to the value of ₱848,452, while the islands abound in excellent grazing lands); lumber (the importations of this commodity by the Army, Navy, and insular government and private individuals amounting to millions of dollars in value, while the islands themselves have virgin forests of most valuable timber possessing lasting qualities and of a durability not found in the timber of other sections of the world); eggs (of which ₱531,144 worth were imported last year, every peso of which is an unnecessary importation); fresh vegetables and fruits (great quantities of which are imported every year from China), and refined sugar (the whole of which should be produced and refined in the islands instead of being exported in the form of raw sugar and again reimported as the refined product).

NATIONALITY OF EMPLOYEES.

Of the total classified customs employees at Manila something over 65 per cent are Filipinos, and of the unclassified employees 100 per cent.

IMMIGRATION AND EMIGRATION.

The total number of immigrants coming into the islands during the year was 18,293, and of those departing 11,013. There has been a great decrease in the Japanese immigration as compared with the previous year, 1,235 having arrived in the fiscal year 1905 and only 277 during the past year, a decline of 77½ per cent. During the past year also 371 Japanese left the islands. About 1,200 more Chinese have entered during the year than have departed, owing mainly to the return of Chinese who had left the islands under permits in former years.

REFUND OF DUTIES ON HEMP EXPORTS.

This office and the Commission have repeatedly recommended that Congress should repeal that part of its act of March 8, 1902, providing for the refund of duties paid on hemp exported to the United States. That recommendation is here renewed, for the reasons so often stated, that its operation is wholly to deplete the insular treasury solely for the benefit of certain manufacturers in the United States.

NATURALIZATION OF ALIENS IN THE PHILIPPINE ISLANDS.

It is again recommended that Congress be requested to make provision for the naturalization as citizens of the Philippine Islands of aliens possessing the proper qualifications and residing therein.

HARBOR IMPROVEMENTS.

The subject of harbor improvements, although pertaining in part to the bureau of customs, is directly within the province of the secretary of commerce and police and full information upon that subject will doubtless be found in his report.

DINGLEY TARIFF ON TOBACCO AND SUGAR.

It will be fruitless here to repeat the arguments that have been thoroughly presented before Congress urging a material reduction or total abolition of the customs duties imposed by the Dingley tariff upon sugar and tobacco products produced in the Philippine Islands and imported thence into the United States. It is confidently believed that at the next session of Congress the desired legislation will be secured.

I recommend, as before, that the Commission renew its recommendation in that behalf.

Full detailed statistical information will be found in the report of the insular collector of customs, which is hereto annexed and marked "Exhibit No. 2."

BUREAU OF INTERNAL REVENUE.

Practical experience under the internal-revenue law has completely demonstrated the wisdom of its enactment. It was indispensable for the purpose of revenue and redistributed the burden of taxation, placing it very largely on articles of optional consumption and relieving many small industries from an annoying and burdensome tax that had before rested upon them.

During the first eleven months of its operation, from August 1, 1904, when it went into effect, until the end of the fiscal year, June 30, 1905, it was but partially in force and the last fiscal year has been the first year of its full operation.

The machinery for its proper enforcement has now been put in proper order and the law has had practically one full year to demonstrate its usefulness. A summary of the collections resulting therefrom is as follows:

Internal-revenue law.

Manufacturers of alcohol and tobacco products	₱4, 328, 144. 37
Licenses—dealers in alcohol and tobacco products	494, 321. 63
Licenses—merchants, manufacturers, and common carriers	1, 365, 392. 50
Licenses—occupations, trades, and professions	308, 184. 49
Mines and mining concessions	15, 264. 72
Banks and banking	155, 160. 50
Insurance companies	20, 181. 18
Documentary stamp taxes	166, 167. 38
Cedulas	1, 756, 777. 00
Miscellaneous	125. 13
Forest products (eight months only)	193, 638. 01
Total	8, 803, 356. 91

aside from the work of the bureau in collecting the taxes for the city of Manila, amounting to ₱2,465,780.40; rentals of the San Lazaro estate for a portion of the year, amounting to ₱16,044.50; and receipts under the opium law, amounting to ₱81,424.89.

COST OF COLLECTION.

The cost of collection has been 4.1 per cent of the receipts, exclusive of the expenses incurred by the provincial governments in aiding the collector of internal revenue. Sixty-three per cent of the total amount was collected in Manila and 37 per cent in the provinces.

APPORTIONMENT OF INTERNAL-REVENUE TAXES.

Under the apportionment provisions of act No. 1189, the internal-revenue taxes collected as above will accrue to the insular and various local treasuries as follows:

To the insular treasury		₱5,122,871.80
To the provincial treasuries:		
One-half cedula taxes	₱878,388.50	
Ten per cent other collections	683,049.58	
		1,561,438.08
To the municipal treasuries:		
One-half cedula taxes	878,388.50	
Fifteen per cent other collections	1,024,574.37	
Certain license taxes	216,084.16	
		2,119,047.03
Total		8,803,356.91

from which it appears that the actual revenues secured by the insular government from this source was ₱5,122,871.80.

ALCOHOL PRODUCTS.

The alcohol products of the islands were all consumed here, none having been exported. The taxes collected during the year on spirits amounted to ₱1,303,573.04. As the law had not been in force for a full year during the fiscal year 1905, an exact comparison is unavailable, but there has been a gain of practically 50 per cent on this item.

The amount collected on beer for the year was ₱121,158.40, indicating a slight reduction over the probable production for a like period of the year immediately preceding. There is but one brewery in the islands. Owing to a reduction in the army in the islands there is not as much beer consumed as in former years. Importations of American and German beers are small in amount, the domestic article being superior in quality and lower in price than foreign beers. It is believed that the customs duty on imported beer is sufficient to protect the local brewery from foreign competition.

LEAF TOBACCO.

The demand for leaf tobacco for the manufacture of cigars is much greater than the supply. Little is done toward improving the quality of the leaf or increasing the area under cultivation. Poorer tobacco is in some cases being used for the manufacture of cigars for export, and some brands are becoming thereby discredited. Some new markets in Africa and Gibraltar have been reached in manufactured tobacco, but the export of manufactured tobacco to the United States is nothing.

The amount collected for taxes on cigars for the year was ₱181,998.61, indicating a substantial increase of output. The total export of cigars during the first full year's operation of the law was 81,258,130, China continuing still to be the best customer for Philippine cigars. There has been a decrease in the number exported to Spain. The United States takes one-quarter of 1 per cent of all the cigars exported from the islands. If the United States took all that were exported, which never could occur, in view of the immediate vicinity of the Asiatic market, it would add about 1 per cent to the total number of cigars now being manufactured and consumed in the United States. The last annual report of the United States Commissioner of Internal Revenue to the Secretary of the Treasury states that there is a fairly regular annual increase of over 2 per cent in the number of cigars consumed in the United States, which involves an increase in one year of 225,466,540 as to cigars there manufactured and consumed. If all the cigars manufactured in the Philippine Islands and exported to all countries were exported to the United States only, they would supply the natural increase in the cigar consumption there for about five months, after which the entire present Philippine cigar export trade having been assimilated for all time to come in the American market, the American cigar manufacturer would continue with all of his old trade, plus the regular increase of 2 per cent or more from year to year. It should be remarked, however, that few of the cigars now exported to other countries would be suited to the American market, most of them being of a very low grade; nor would the exporters in these islands be willing to abandon their markets in other countries to send all their cigars into the United States, and many of those manufactured in the islands would continue to be exported to other European countries which sell goods imported into the islands. A taste for the Philippine cigars has not been acquired in the United States. The scarcity of good tobacco lands in the islands to-day available for cultivation and with satisfactory transportation facilities renders it certain that it would be many years before, under the most favorable circumstances, tobacco planters could possibly increase to any marked extent their present output. There is not sufficient good leaf produced in the islands to meet the demands of local manufacturers to make cigars for domestic consumption. The advent, therefore, upon the American market of the Philippine cigars would affect that market to a hardly perceptible degree and would not be felt to any appreciable extent by either the producer of American tobacco or the manufacturer of cigars in the United States.

The cigarettes produced in the islands are mainly consumed here. The tax collected for cigarettes manufactured and consumed in the islands during the year was ₱2,357,613.14, showing a substantial increase over the prior production.

Cigarettes exported during the year numbered 21,062,844, which paid no internal-revenue tax. The total number manufactured and consumed within the islands during the same period was 3,509,038,750, by far a greater consumption of cigarettes per capita doubtless than can be shown for any other country.

MATCHES.

The total collections for the year on domestic and imported matches were ₱243,035.93, representing a substantial increase. There is but one manufactory in the islands, which claims to have, by Spanish grant, a monopoly, established about four years ago in the suburbs of Manila. It now uses native woods for its product. During the first half of the year imported matches, mainly Japanese, supplied 57 per cent of the trade and domestic matches 43 per cent. During the last half domestic matches supplied 58 per cent and imported matches 42 per cent, which facts, on the whole, indicate that the internal-revenue tax upon the domestic product and customs duty upon imported matches have so adjusted matters that neither can obtain a monopoly and enhance the price.

MERCHANTS, MANUFACTURERS, AND COMMON CARRIERS.

The internal-revenue law imposes a tax at the rate of one-third of 1 per cent upon the value of commodities sold in the islands by merchants and manufacturers aside from sales of alcohol and tobacco products, which are exempt from this tax, because otherwise taxed, and the law also excludes the sale of agricultural products by farmers and sales of all articles by petty dealers. There is no tax upon personal property, this tax forming practically a substitute for it. From that tax during the last year ₱1,365,392.50 were collected. As this tax represents one-third of 1 per cent of the total sales that are taxed, a capitalization of the sum collected would indicate a total value of declared sales of commodities during the year to the amount of ₱400,197,966. If to this amount were added the value of the goods and agricultural products not declared for taxation purposes because exempt, the total value of sales actually made during the year would undoubtedly exceed one-half billion pesos.

OCCUPATIONS, TRADES, AND PROFESSIONS.

Collections of specific license tax during the year amounted to ₱308,184.49. A material percentage of these collections resulted from taxes upon cockpits and horse races. There has been an agitation in progress for a considerable time for the restriction of the evils resulting from the excessive indulgence in this kind of gambling. The agitation has resulted in closing many cockpits, and it is probable that during the coming fiscal year the revenues from this source will be substantially diminished.

CEDULAS OR CERTIFICATES OF REGISTRATION.

The cedula is in the nature of a poll tax of ₱1 imposed upon every male person in the islands between 18 and 60 years of age, if paid during the first four months of the calendar year, and ₱2 if paid thereafter. Over 80 per cent of the cedulas sold were of the ₱1 class. Most of the members of the non-Christian tribes are exempt from this tax, as well as a small number of certain other specified classes. If it be assumed that one-fifth of the people of the islands are within the taxable limits, it would appear that practically the whole Christian population had purchased cedulas and that the tax had been practically collected from all who are liable to it.

LIQUOR LICENSES IN MANILA.

On the 30th day of June, 1905, there were 1,565 persons in Manila authorized to sell alcoholic products in some form, and on the same date in 1906, 1,552. These statistics include not merely bars but also restaurants, hotels, theaters, wholesale liquor dealers, distillers, breweries, drug stores, and dealers in the native wine, or " vino." On the 30th day of June, 1906, there were 1,309 licensed venders of native wine in the city, an increase of 43 during the year. These dealers sell nothing but the native wines, which are consumed in very small quantities at a time by the natives, who, notwithstanding the large number of places at which the native drink is sold, are among the most temperate people in the world. A drunken Filipino is a very rare spectacle; nor do the Filipinos patronize the American bars or saloons.

OPIUM LAW.

This law was passed, after public discussion, on March 8, 1906, and was made effective April 1, 1906. Its purpose was to restrict the sale and suppress the evil resulting from the sale and use of opium until March 1, 1908, when its importation or use for any but medicinal purposes is forbidden by act of Congress. It was impracticable, in view of the fact that the prohibition of the importation and use of opium for any but medicinal purposes was to become effective March 1, 1908, to enact such legislation as would be desirable for the purpose of greatly restricting the evil had the time of prohibition been more remote. A committee, consisting of the Right Rev. Charles H. Brent, Dr. José Albert, and Maj. Edward C. Carter, U. S. Army, had, by authority of the Commission, made thorough investigation into the conditions of the opium traffic and the use of the drug in various countries of the Orient and had reported its conclusions to the Commission. The theory of their recommendations, briefly stated, was that the government should carry on the business of manufacturing and selling opium as a governmental monopoly, with a registration of all opium smokers and a gradual extirpation of the habit. This system having been found impracticable, in view of the great expense of establishing a governmental monopoly and manufacturing establishments for the short time left before actual prohibition came into effect, there was nothing left for the Commission but to deal with the subject as best it could for the short time before full prohibition. It is probably true that the system recommended by that committee, with some modifications, would be the wisest and best solution of this most difficult problem, but that system is not feasible unless the act of Congress shall be modified, allowing the question of prohibition to be determined by local authorities as experience may demonstrate its wisdom and may point out the proper time when such a measure could be put into force. It was understood that such was the intention and real recommendation of the committee aforesaid. The enforcement of the opium law has been intrusted to the bureau of internal revenue. It has not been in force a sufficient length of time to make complete provision for the organization of the registration and other administrative work required by law. In Manila 285 persons were found with opium in their possession, crude or prepared for smoking or in the form of alkaloids, to the amount of over 7 tons, and in the islands to the amount of 10 tons. Taking as a basis for estimates the customs figures on duty-paid opium imported into the Philippine Islands of late years, it would appear that the normal amount of opium smoked here in one year would be about 100 tons, the retail price of which has been about ₱5,000,000. It is undoubtedly true that opium merchants and smokers had stocked up before the law imposing additional tax upon imports became effective and were able to hide the greater portion of the drug from the scrutiny of the internal-revenue agents, and it is probably also true that considerable quantities are at present being smuggled into the islands in such manner as to evade customs inspectors. It is also probable that a considerable proportion of the persons who formerly smoked and otherwise used opium are reforming, owing to the difficulties of obtaining the drug and the facilities furnished by the government for reformation. At present opium is worth its weight in silver in the Philippine Islands, and small quantities could be concealed about the person of incoming passengers and among the luggage of importers and merchants in such manner that discovery is very difficult.

Free treatment in hospitals is provided for victims of the opium habit who desire to be cured. At the outset the law was not enforced with the utmost rigor, in view of the hardship and physical suffering which would result from such enforcement before free medical treatment had been provided. A person now discovered smoking opium is arrested and required either to take out the certificate and pay such fine as the court may impose or to enter the hospitals as a bona fide patient seeking to be cured of the use of the drug. Under the law, Americans, Filipinos, and others not Chinese can not receive a user's certificate and their only alternative from prosecution when found using the drug is to take the hospital treatment. From April 1 to June 30, 1906, there were issued 4,845 certificates to habitual smokers, of which 2,519 were issued in Manila. The estimates as to the number of persons in the islands who are addicted to the use of the drug vary greatly; probably 20,000 confirmed users will eventually take out certificates. Many Filipinos have applied for such certificates, as well as some Americans and foreigners, but the law forbids issuance to them.

Thirty-five wholesale and 135 retail dealers' licenses have been issued between April 1 and June 30. The law is not intended as a revenue producer, although the tax on crude and prepared opium and alkaloids is very heavy. The total amount collected under the law for three months ending June 30, 1906, is ₱81,424.89.

NECESSITY OF INCREASING THE WORKING FORCE.

Legitimate manufacturers and dealers in alcoholic and tobacco products have complained that there has been much illicit manufacture and sale, and that they are exposed to an unfair competition. This undoubtedly is true to a certain extent, and it is impossible for the internal-revenue bureau to cope with this difficulty without an additional number of agents and inspectors. While the employment of additional aid will cause increased expenses, the additional revenue thus raised will undoubtedly more than compensate for the increased expenditures, besides furnishing adequate protection to the legitimate manufacturers and dealers. For this reason it may here properly be stated, although it covers a transaction subsequent to June 30, 1906, that the Commission, realizing the importance of these considerations, has by its annual appropriation bill for the fiscal year 1907 made such provisions as adequately to meet the difficulties here stated.

The report of the collector of internal revenue is herewith annexed and marked "Exhibit No. 3."

THE CITY OF MANILA.

The reorganization act passed October 26, 1905, provided that the city of Manila should thereafter report to the secretary of finance and justice instead of to the governor-general, as before.

The financial situation of the city requires special consideration. Its disbursements for the fiscal year 1906 were greater than those in any prior year, aggregating ₱5,843,554.24, of which ₱1,634,728.14 was for permanent public improvements and ₱233,335.98 represent interdepartment transactions—that is, payments made by one department of the city government to another for services rendered to the former by the latter. The actual current expenses of the city for the year, therefore, were, excluding permanent improvements and interdepartment charges, ₱3,975,490.12. The city has gone rapidly forward in the way of public improvements, as shown by the above statement.

All the expenditures of this character were desirable and justified had the city been in financial condition to undertake the improvements. The city authorities failed fully to take into account the great diminution in their revenues caused by the enactment of the internal-revenue law. Under the old law the great industries of the islands, which were largely located in Manila, paid tribute to the city treasury, while under the present internal-revenue law those large establishments, such as distilleries, breweries, cigar and cigarette factories, etc., contribute to the general treasury for the benefit of the consumers scattered all over the islands, and not for the benefit of the city of Manila alone, which receives only its pro rata share of the internal-revenue taxes based upon population.

At the end of the fiscal year 1905 the city had a deficit of ₱72,836.73. The new internal-revenue law reduced its income to the amount of ₱900,000, more or less, and the tax levy on real estate for the calendar years 1905 and 1906 realized materially less than in prior years. Owing also to the delay in passing the reorganization act (No. 1407), it was impracticable to pass the appropriation bill for the fiscal year 1906 until December 15, 1905; meanwhile the city had gone on upon its former schedule of expeditures under authority of law. Undoubtedly the scale of expenditures for the first half of the fiscal year was materially larger than it would have been had the appropriation bill been passed on or near the 1st of July, when properly it ought to have been enacted. The city authorities also made their estimate of income upon a basis of 2 per cent tax levy on real estate, but the tax rate was subsequently fixed at 1½ per cent, which fact also disarranged the estimates of the municipal board, largely reducing their income. The estimates for appropriations for public improvements, when made, contemplated about the same deficit at the end of the year as at the beginning, but the actual deficit, not including special funds like the sewer and waterworks bonds issue, etc., at the end of the year amounted, as stated by the municipal board, to ₱936,332.34, including loan account with the insular government for the Luneta extension, amounting to ₱182,014.05, and the balance due the insular government on account of purchase of transportation equipment and corral, ₱106,569.24, the actual deficit and sum due the insular government on general account being ₱647,749.05. It is apparent that the city has been living beyond its means, and has not yet adapted itself to the new conditions imposed by the internal-revenue law, and it is necessary that radical measures be taken to cause it to live within its income. While permanent improvements are most desirable, yet they can only be made as rapidly as the conditions of the treasury warrant. Radical retrenchment is also necessary in most of the departments of the city, and it is believed that a great reduction can be made in the expenses of administration without material impairment of efficiency. The committee appointed by executive order No. 14, series 1905, has extended its work to the city of Manila, and has recently made a report advising certain consolidations and changes, which the committee believe will materially reduce the expenses of administration. It has not been feasible yet, for want of time, to act upon that report, but action will be taken before the passage of the appropriation bill for the city of Manila for the fiscal year 1907, and an effort will be made not only to keep the expenditures for the coming year within the income, but also materially to reduce the existing deficit.

The municipal board estimate a total expenditure of ₱3,500,000 for current expenditures for the fiscal year 1907, ₱158,740 for sinking fund and interest on bonds covered by existing permanent appropriations, and also a first payment of ₱35,000 on the Luneta extension loan, making a total estimated expenditure of ₱3,693,740. These expenditures are ₱475,000 less than was appropriated last year, and the municipal board believes that, including 30 per cent contribution by the insular government authorized by law, the expenditures will be well within the income and provide a substantial reduction of the present deficit.

The estimated budget for the city of Manila for the ensuing year will be found in a later portion of this report. This estimate, however, does not provide for permanent improvements, which must be to a considerable degree suspended until the finances of the city are in better condition.

The municipal board recommends certain additional taxes for the purpose of procuring more revenue, but it is believed that the burden of taxation ought not to be increased in any respect within the city and that adequate remedy is to be found in reduction of expenses and not in increased taxation.

The subject of asking Congress to authorize a bond issue for public improvements, aside from the sewer and water works bonds, has been to some extent discussed, but the bonded debt of the city already authorized is equal to 10 per cent of the assessed value of its taxable property, and this limit ought not to be passed by any well-governed municipality. The bonds now authorized and which will undoubtedly be all required for sewer and water works purposes, will require an annual expenditure of ₱475,000 for interest and sinking fund, a sufficiently heavy burden for the present. It is therefore recommended that authority for a further bond issue be not asked of Congress. The whole matter of the city's finances must come down to the basis of the city's living within its means.

During the year the city has entered into a contract with the Hospicio de San José under which juvenile offenders sentenced by the municipal court and by the courts of first instance are cared for, fed, clothed, and instructed, to their physical, mental, and moral benefit. This arrangement establishes practically a reform school, thus supplying a much needed want.

The accounts relating to sewer and water works bonds issue will appear elsewhere in this report. One million dollars of the authorized issue only have been sold, and the remainder will doubtless be needed in January, 1907, and January, 1908, respectively.

The real estate owned by the city is appraised at ₱5,566,957 and its personal property at ₱1,688,202.53. The assessed valuation of real estate subject to taxation within the city is ₱80,525,235.

During the year much work has been done in the way of establishing street lines and grades, preparations of plans of lands expropriated for new streets and for street widening, making proper surveys for and establishing building lines, preparation of maps, and general improvement of the streets and parks. The city is physically in excellent condition and is constantly growing more and more attractive.

Among the public improvements carried out during the year may be mentioned the construction of concrete river walls on the Pasig River below the Bridge of Spain, the construction of the new Ayala steel bridge, the completion and opening of the new Binondo lift bridge, the construction of the San Miguel bridge, expenditure of large sums upon the Luneta extension, filling in of moats, construction of curbs, purchase of lands, and construction of markets, construction, widening, and straightening of streets generally, purchase of land, lot 1, block 47, Ermita, the purchase of rights and traffic facilities in the Vitas Canal, and other similar works, aggregating ₱782,610.58.

New buildings of strong material were constructed in the city during the year to the value of ₱1,860,801, and of light materials to the value of ₱248,973.

The police department has been efficient, but in the interest of economy the force will be very greatly reduced. In 1901 there was an authorized force of 804 men, though under the direction of the provost marshal the city had before enrolled about 2,000 men for duty as policemen within the city limits. The average for the fiscal year 1905, was 715 men, and for the fiscal year 1906, 700. This force is to be reduced to 500 men, of which not more than 200 will be Americans. The city is one of the most orderly in the world, and it is believed 500 men will be fully adequate for the whole needs of the city.

The fire department has been very efficient. The following tabulation of losses by fire for the fiscal years 1903 to 1906, inclusive, bears eloquent testimony to the value and efficiency of this department:

Losses for 1903	₱1,670,650
Losses for 1904	468,911
Losses for 1905	₱135,921
Losses for 1906	76,192

including buildings and contents in each case, the loss for 1906 upon buildings being but ₱50,175.50. The total loss due to fire on buildings was approximately one-seventh of 1 per cent of the value of the buildings in the city subject to taxation.

It has been found that the Filipino firemen render uninterrupted service, value their positions very highly, and are constantly improving in efficiency.

The attendance at the city schools constantly increases, and a greater number of schoolhouses are necessary. The increase in the number attending the day schools is shown in the following tabulation:

June, 1903	3,046
June, 1904	5,767
June, 1905	7,803
June, 1906	8,311

The work of installing a new water supply has now passed its initial stages. The Mariquina River is to be dammed at a point in the extreme suburb of the town of San Mateo, about 23 miles from Manila, where there is to be constructed a reservoir with a capacity of 2,000,000,000 gallons at an elevation of 212 feet above the sea level. At a point nearer Manila, at about 112 feet above sea level, another reservoir of 50,000,000 gallons capacity will be built, from which the water will be delivered to the city. The whole system will be operated by gravity. Contracts for constructing the dams and headworks, furnishing the steel plates and rivets, manufacturing and laying the steel pipes, constructing of necessary tunnels and conduits, reservoirs and gatehouse works have all been let and the work is under way. Contracts already let involve an expenditure of ₱2,051,621.52 and require the work to be completed by July 1, 1908.

The plans for the new sewerage system are as set forth in the report one year ago and involve the discharge of the whole sewage of the city into the bay at a distance of 6,500 feet from the shore, pumping stations being so distributed as to bring the sewage finally all into the large discharge pipe emptying into the bay as above stated. Contracts for furnishing materials and laying pipes and other described construction have, by advertisement, been let amounting to ₱3,262,106.40. The successful bidders for all the sewer and waterworks construction have been American individuals or corporations.

The estimates are that the sewer and waterworks systems can both be completed for the sum of ₱8,000,000, the amount of the bond issue authorized, including the premiums secured on sale of the bonds.

Full details as to the working and receipts and expenditures of every department of the city government will be found in the interesting report by the municipal board, hereto annexed and marked "Exhibit No. 4."

THE TREASURY AND THE AUDITOR'S OFFICE.

The report of the insular treasurer is hereto annexed and marked "Exhibit No. 5." The final report of the auditor upon all accounts for the fiscal year 1906 is annexed to this report and marked "Exhibit No. 6."

The auditor reports that the work of his office is current, and that accounts are being settled immediately upon their receipt, and, with the exception of a few delayed insular accounts from remote points and reports from some of the provinces in which the district auditors have been delayed in the completion of their work, the accounts for the fiscal year are complete.

There has been a material increase in the force in the auditor's office over the preceding year, owing to the provisions of the accounting act (No. 1402), by virtue of which the auditor took over from the treasury and other bureaus the field examinations of accounts and the work of fixing, exacting, and filing of the bonds of insular, provincial, and municipal officials required by law as security for public money or property in their hands. Under that act there was created a corps consisting of a chief district auditor and such number of district auditors as might be detailed from the authorized personnel of the bureau for the purpose of auditing provincial accounts. This auditing is now done in the respective provinces instead of in Manila, as heretofore. Much difficulty was found in inaugurating the new system by reason of a lack of a sufficient number of men of ability and experience to do the work. The corps had to be created out of hand for such field work, in which men must act largely upon their own initiative and judgment, and at once. Under the new system, notwithstanding the difficulties, the work of auditing provincial accounts is further advanced than ever before at a corresponding period and is being done effectively.

By act No. 1482, passed May 1, 1906, the auditing of municipal accounts was placed under district auditors, subject to the jurisdiction and supervision of the insular auditor. The advantage of the change from the system of auditing these accounts for their respective provinces by 38 provincial treasurers, as it existed under the old system, is already apparent in many ways. The provincial treasurers themselves and those cognizant of the affairs in the municipalities have forwarded statements of the beneficial results of the change. There are 625 municipal organizations in the islands, and the accounts of all of the municipal treasurers must be audited. These aggregate an annual expenditure of ₱4,800,000.

RECEIPTS AND DISBURSEMENTS.

During the fiscal year 1905 there was an excess of net expenditures over net income receipts of ₱1,398,723.92, while the accounts at the close of the fiscal year 1906 show an excess of net receipts over net disbursements amounting to ₱3,180,647.43. This favorable result is due in part to greater economy in expenditure, in part to increased collections from the bureau of internal revenue more than sufficient to counteract the decrease in customs receipts, and in part to the construction of public works out of proceeds of bond issues authorized by Congress, instead of from current receipts. Without the internal-revenue law, however, the government would have been unable to meet its obligations.

The sums available for appropriation from general funds at the close of the fiscal years 1901 to 1906, inclusive, are as follows:

1901	₱7, 800, 000. 00
1902	8, 000, 000. 00
1903	4, 346, 000. 00
1904, a deficit of	₱540, 599. 52
1905, available	585, 021. 36
1906	2, 572, 268. 38

The favorable statement for the last two years shows that the government is now upon a sound basis financially and that the resumption of appropriations for permanent public works from current income is now practicable. It is most undesirable to exhaust the whole borrowing power of the government given by acts of Congress for the constructions of permanent improvements. There should be some reserve left in the authority referred to to meet special contingencies. Meanwhile, with constant economy in the expenses of administration a considerable sum can be appropriated each year from current revenues for the construction of important work of a lasting character and essential to the complete prosperity of the islands.

THE SUSPENSION OF THE LAND TAX FOR 1906.

The satisfactory result of the finances for the last year has been secured, notwithstanding the enactment of act No. 1455 on February 19, 1906, which provides for a total suspension of the land tax throughout the islands outside the city of Manila for the calendar year 1906, and for an appropriation from insular funds to the provinces and municipalities of the total amount of land taxes collected by them, respectively, in the year 1905. This appropriation was made payable in twelve equal monthly instalments. This legislation has given to the agriculturists in the municipalities and provinces a most welcome rest from the burden of the land taxes for one year, and has still provided for them the same resources for disbursement in the support of schools, construction of roads and bridges, and other purposes for provincial and municipal uses, as they had available for those purposes before the suspension of the land taxes. Six of the installments have been paid aggregating ₱1,317,694.30, in addition to the sum of ₱16,160.69 paid to the province of Cebu under special provisions. The refund from the insular treasury did not apply to the Moro Province, the authorities of that province having requested the continuance of the land tax therein. The city of Manila was not affected by this legislation, and therefore no appropriation was made for it.

Under the act referred to, the sum above stated will likewise be disbursed during the first six months of the fiscal year 1907 from the insular treasury to the provinces and municipalities, and therefore will affect the budget for the coming year.

NET RECEIPTS IN AND WITHDRAWALS FROM THE TREASURY.

The net income receipts of the government for the fiscal year 1906, as deposited in the insular treasury, were ₱22,890,063.82, segregated as follows:

Customs revenue	₱14, 862, 485. 62
Postal revenue	385, 895. 08
Internal revenue accruing solely to the insular government	5, 247, 398, 09
Miscellaneous revenue	2, 394, 285. 03

No refunded or refundable items or such as the treasury receives only as agent are included in this statement. Customs collections in the United States for account of the Philippine government during the fiscal year 1906 were ₱1,076,701.40. This sum, however, does not include the collections for June, 1906, which were abnormally large, amounting to ₱245,463.44, and which were not deposited or made available for the insular government during this fiscal year. It appears from the auditor's report that the customs collections made in the United States on Philippine products imported, and which by law are refundable to the Philippine treasury, were less than the returns from the Insular treasury to the exporters of duties collected on hemp exported from the islands to the United States, the whole provision resulting in a net loss to the insular government.

The net expense withdrawals are chargeable as follows:

The Philippine Commission	₱79, 610. 82
The executive	619, 492. 12
The department of the interior	2, 056, 753. 90
The department of commerce and police	6, 084, 360. 98
The department of finance and justice	2, 639, 074. 72
The department of public instruction	4, 532, 320. 46
Unassigned service	3, 697, 803. 39
Total	19, 709, 416. 39

This sum was disbursed by the various bureaus of the government as follows:

Philippine Commission	₱79, 610. 82
Executive department:	
Executive	106, 020. 00
Executive bureau	430, 074. 69
Bureau of civil service	75, 508. 22
Bureau of archives	5, 751. 45
Official Gazette	2, 137. 76
Department of the interior:	
Bureau of health	811, 449. 17
Bureau of lands	252, 843. 98
Bureau of science	272, 632. 15
Bureau of agriculture	264, 141. 54
Bureau of forestry	148, 191. 32
Quarantine service	120, 864. 10
Weather bureau	91, 313. 38
Mining bureau	10, 259. 56
Philippine civil hospital	68, 431. 51
Civil sanitarium, Baguio	16, 627. 19
Department of commerce and police:	
Bureau of constabulary	3, 149, 133. 96
Bureau of public works	512, 748. 60
Bureau of navigation	1, 539, 932. 71
Bureau of architecture (excess of refunds)	67, 947. 25
Bureau of posts	647, 097. 87
Coast and geodetic survey	167, 504. 77
Signal service	120, 435. 65
Superintendent Intendencia Building	3, 383. 95
Superintendent Oriente Building	9, 195. 71
Custodian Sta. Potenciana Building	1, 044. 38
Custodian Fortin Building	1, 830. 63
Department of finance and justice:	
Bureau of justice	823, 832. 98
Bureau of audits	312, 883. 63
Bureau of the treasury	135, 712. 23
Bureau of customs	935, 779. 57
Bureau of internal revenue	430, 866. 31

Department of public instruction:	
Bureau of education	₱3.077,296.87
Bureau of prisons	870,161.91
Bureau of supply (excess of refunds)	84,221.20
Bureau of printing	388,663.61
Ethnological survey	6,378.15
Bureau of cold storage	272,094.02
American Circulating Library	1,947.10
Unassigned service:	
Benguet improvements (excess of refunds)	₱8,601.14
Consulting architect	9,018.80
St. Louis Exposition board	6,572.29
Chief quartermaster, division of the Philippines (excess of refunds)	1,603.74
Contribution to city of Manila, 30 per cent of net withdrawals	1,338,385.74
Annual payment to Sultan of Sulu and his advisers	18,245.00
Interest on public improvement bonds	220,375.00
Interest on friars' lands bonds	420,000.00
Payments to provinces	1,509,206.45
Miscellaneous	186,204.99
Total	19,709,416.39

Included in the unassigned service are such items as ₱1,338,385.74, the insular government's contribution to the city of Manila; interest on public-improvement bonds, ₱220,375; interest on friar-land bonds, ₱420,000; payments to provinces in lieu of the suspended land taxes, ₱1,333,854.99, and other minor special payments.

The net income receipts of the insular government therefore exceeded the net expense withdrawals from the treasury by the sum of ₱3,180,647.43.

The actual expenditures, as will appear from the auditor's final report, do not differ very materially from the net expense withdrawals here given.

AGGREGATE OF ALL FUNDS IN THE HANDS OF THE INSULAR TREASURER, JUNE 30, 1906.

General revenue account	₱19,392,404.64	Pfs. 132,484.23
Depositary account	11,217,563.94	1,215.19
Certificate redemption fund	14,410,000.00	
Total	45,019,968.58	133,699.42

These funds were distributed as follows:

In treasury vaults	₱18,065,090.20	$4,606,299.57	Pfs. 133,699.42
Checks on hand for deposit	108,557.34		
In banks at Manila	308,697.77		
In banks in United States		8,513,096.315	
(a) In banks at Manila (special deposits)	280,733.08	9,000.00	
In hands of provincial treasurers for exchange	116.42		
Total	18,763,176.81	13,128,395.885	133,699.42

This statement includes not merely the general revenue account, but the depositary accounts pertaining to the gold-standard fund and other depositary accounts and the special funds reserved as security for the silver certificates.

THE CITY OF MANILA.

The accounts of the city of Manila have been elsewhere stated in this report and need not be here repeated.

THE CONGRESSIONAL RELIEF FUND.

At the close of the fiscal year 1905 there were in the insular treasury available for appropriation ₱1,228.53 of the Congressional relief fund, while at the close of the fiscal year 1906 the sum available was ₱107,495.24, the increase being due to the repayments to allotments which reverted to the fund. The sum of ₱524,635.97 was withdrawn for disbursements during the fiscal year from appropriations mainly made before the beginning of the year. At the close of the fiscal year 1906 there were allotments of appropriations of the fund undrawn amounting to ₱376,067.72. In other words, there now remains available for the Commission to appropriate ₱107,495.24 out of the original fund. There is also available for allotment, although heretofore appropriated but not allotted, the additional sum of ₱101,824.

FRIAR-LAND FUNDS.

The final payment on account of the friar-land purchase was made in October, 1905, and amounted to ₱7,043,314. The total withdrawals from the fund during the fiscal year were ₱7,255,457.34, and there was left in that fund a surplus or excess resulting from the proceeds of the bond issue of ₱1,024,656.98, arising by reason of a reduction in the original purchase price of the lands against which the friar-land bonds were issued, as a result of resurveys and compromises. This sum has been determined by the Secretary of War and by the Philippine Commission to be available for the general expenses of administering the friar lands, as well as for sinking-fund purposes to pay the principal and interest thereon.

Under the provisions of act No. 1284, ₱420,000 were paid from general funds as interest upon friar-land bonds, while the general treasury profited by interest received through the period while the fund was on special deposit to the amount of ₱158,152.10. Part of these transactions occurred before the total amount due for the friar lands had been determined and the amount of the surplus was unknown.

PUBLIC WORKS AND PERMANENT IMPROVEMENTS.

During the year public works have been met from funds specially borrowed under bonds issued for that purpose, interest and sinking-fund charges only being included in the regular expenditures. The net expense withdrawals on this account during the fiscal year were as follows:

From the fund arising from the first and second series of bonds, ₱3,018,327.34, including a loan to the city of Manila of ₱350,000 for the Luneta extension.

BONDED INDEBTEDNESS.

The bonded indebtedness of the insular government, aside from the certificates of indebtedness relating to the gold-standard fund, a statement of which is elsewhere found in this report, consists of two series of public-improvement 4 per cent bonds. Five million pesos of bonds had been sold prior to the date of the fourth annual report from this office, and a second series of ₱2,000,000 was sold on the 15th day of February, 1906, on which a premium of ₱167,494 was received. These bonds run thirty years, but may be paid at the expiration of ten years. It is estimated that the bonds will be paid partly by sinking funds and partly by the issue of a new series at the expiration of ten years, from which it will appear, figuring them as ten-year bonds, that the bonds were sold on most favorable terms.

INSULAR BUDGET FOR THE FISCAL YEAR 1907.

There is always difficulty in forecasting for a year the financial condition of a government like that of the Philippine Islands, where the legislature is always in session and where expenditures not authorized at the beginning of the year may be provided for later, and where unforeseen emergencies and demands are liable to occur from time to time which the legislature feels called upon to meet. Notwithstanding these difficulties, the estimate in the fourth annual report from this office at the end of the fiscal year 1905 was that there would probably be available at the end of the year a surplus of general funds for appropriation to the amount of ₱2,991,505.22. The actual surplus of general funds available for appropriation at the end of the fiscal year 1906 was ₱2,572,268.38. At the time of making the fourth annual report the suspension of the land tax and appropriation from insular revenues to the provinces and municipalities to provide what they had lost by the suspension of the land tax had not been authorized by law and was not taken into consideration. This would more than offset the difference between the estimated available surplus and the actual one, and would indicate that the estimate was on the whole a conservative one.

The total net revenues estimated in the fourth annual report as accruing to the general government during the fiscal year 1906 were stated at ₱22,714,650.08.

The actual receipts amounted to	₱22, 890, 063. 82
The amount of disbursements for insular purposes for the fiscal year 1906 was estimated at	18, 140, 711. 00
The actual disbursements for these purposes were	19, 709, 416. 39

the difference being more than accounted for by the appropriation afterwards made for refunding to provinces and municipalities the amount of their land tax collections during the prior calendar year.

It is apparent, therefore, that fairly accurate forecasts were made in the last report. That report, however, was made after five months of the fiscal year had elapsed and the statistics of receipts were available for those five months. The present forecast as to receipts will be made mainly upon the basis of information accruing from the operations of the various sources of revenue for the fiscal year 1906. The customs receipts showed a great falling off during that year from the prior year, and conditions do not yet exist to warrant the assumption that the falling off in such receipts that has been apparent for the past two years will not continue to some extent during the coming year. On the other hand, it is probable that the receipts from the bureau of internal revenue will exceed those for the past year because of a more thorough working of the system and complete organization of the collecting forces, and for other reasons.

Another element has to be taken into consideration in the forecast for the coming year. Heretofore the earnings of the various bureaus have been treated as miscellaneous receipts. Appropriations have been made for the expenses and operations of the bureau irrespective of such receipts, which were covered into the general treasury. Under the system that has been inaugurated for the fiscal year 1907 each bureau has an authorized expenditure stated in the appropriation bill for specific purposes there defined; but the appropriation itself, in case of those bureaus which have earnings in distinction from pure tax collections, is only for the amount of the authorized expenditure less the estimated earnings of the bureau. These earnings accrue in very small part for work done or material and supplies furnished for the general public, but mainly for services rendered, material and supplies furnished to other bureaus and departments of the insular government or to provincial governments. For instance, the bureau of navigation has an authorized expenditure for the full amount deemed to be necessary to maintain the bureau during the year, but much of the work of that bureau is in providing transportation for officials or employees or merchandise pertaining to other bureaus or to the provinces. The bureau of navigation charges the proper bureau or province for the services which it has rendered, and the earnings thus accruing are deducted from the actual amount of the authorized expenditures in order to determine the amount of the necessary appropriation, its earnings being made likewise available. This system of bookkeeping does not in the slightest degree change the actual expenditures of the government or its income. It has been urged that such a system of accounting is more in consonance with the ordinary conduct of business enterprises, and particularly that it tends materially to diminsh expenditures, because bureau chiefs will be more cautious about incurring expenditures from their appropriations by the employment of other bureaus' services when they know that such expenditures will be charged against their own appropriations. This last consideration undoubtedly is of importance and is effective in reducing appropriations. It is not believed, however, that this system or statement furnishes to the public in general as simple and easily comprehended a statement of the actual earnings of the bureau as the former method, which shows at a glance the earnings of every bureau, which appear as items in miscellaneous receipts.

PROBABLE EXPENDITURES FOR THE FISCAL YEAR 1907.

By act No. 1527, ₱14,735,786.06 have been appropriated for the regular insular service for the fiscal year 1907.

By recurring appropriations there will be required during the year for interest upon the friar-land bonds	₱560,000.00
For interest during the year upon permanent improvement bonds	280,000.00
For regular recurring donations to the Moro sultans and datos	14,450.00
By act No. 1455 for refund to provinces and municipalities of the amount of land taxes	1,333,854.99
Making a total for the year of	16,924,091.05

The whole of the ₱560,000 above stated as being required for interest upon the friar-land bonds during the year will be diminished to some extent by virtue of act No. 1284, which provides that the payment of interest upon the friar-land bonds shall be made from general funds only so far as the proceeds of sale and rental of the friar lands shall be insufficient to pay such interest. It is impossible at this time to state what such proceeds will be for the current year.

Appropriations for the city of Manila for the fiscal year 1907 have not yet been made, but the estimate of the city authorities for its indispensable expenditures is ₱3,534,144.74, besides the payment of interest on the Manila water supply and sewerage bonds and bond issue sinking fund, ₱158,740, a total of ₱3,692,884.74.

The statement, therefore, of the probable expenditures will be:

Total for insular purposes	₱16, 924, 091. 05
Total for city of Manila purposes	3, 692, 884. 74
Total probable expenditure	20, 616, 975. 79

Some deficiency appropriations may be necessary, but probably none ought to be made for the items or classes of items covered by the existing appropriation bill. New emergencies, however, are liable to arise requiring expenditures not now contemplated. It is believed, however, that the probable increase in the internal-revenue receipts will fairly offset such possible deficiency appropriation.

Included in the appropriations for the fiscal year 1906 was ₱50,000, which constitutes a working capital for the manufacturing department of the bureau of prisons, and it is understood that no appropriations will hereafter be made for that division of that bureau, its earnings constituting a recurring fund for the purchase of necessary materials and supplies.

For the bureau of printing ₱50,000 was appropriated as a working capital, which undoubtedly will be unnecessary to be repeated hereafter.

No money was appropriated for the bureau of cold storage, but enough of its earnings to carry on its work was made available.

PROBABLE RECEIPTS FOR THE FISCAL YEAR 1907.

As before stated, it will be estimated that the receipts from customs and from the internal revenue during the coming year will aggregate the same as the receipts from these two sources during the past fiscal year, the possible decrease in customs receipts being offset by the probable increase in internal-revenue receipts.

The receipts from miscellaneous sources, however, will now be treated in a materially different manner from what they have been before, because many of them are not treated as miscellaneous receipts and deposited in the insular treasury to the credit of that account, but are made available for expenditures by the different bureaus in addition to their appropriations, and are, upon being collected, credited in the treasury, not to the account of miscellaneous receipts, but to the appropriation for the particular bureau from which such earnings accrued.

The estimated receipts, therefore, for the fiscal year 1907 are as follows:

Net customs revenues		₱14,862,485.62
Net internal-revenue receipts available for general purposes of the insular government		5,247,398.09
Miscellaneous receipts:		
Bureau of cold storage, above operating expenses	₱400,000.00	
Cable concessions	100,000.00	
Interest on general fund deposits	240,000.00	
		740,000.00
Total		20,849,883.71
The entire revenues for the city of Manila for the fiscal year 1907, as estimated by the municipal board, will amount to		2,700,000.00

Total receipts.

Net revenues for the insular government	₱20,849,883.71
Entire revenues for the city of Manila	2,700,000.00
Total estimated net revenues of the insular government and the city of Manila	23,549,883.71

Summary.

The final result, therefore, is as follows:

Total receipts estimated for the year, including revenues accruing to the city of Manila		₱23,549,883.71
Total appropriations for the insular government	₱16,924,091.05	
Estimated appropriations for the city of Manila	3,692,884.74	
		20,616,975.79
Showing an apparent surplus for the operations of the year of		2,932,907.92

To this apparent surplus for the operations of the fiscal year 1907 may be added the sum available for appropriation at the end of the fiscal year 1906, ₱2,572,268.38, making a total sum available for appropriations at the end of the year, if no provisions are made for the construction of public works out of general revenues, ₱5,505,176.30.

It is believed that there should be in the treasury at all times at least from three to four million pesos as a reserve fund to meet contingencies. Deducting, say, ₱4,000,000 from the aggregate surplus possible at the end of the year, it would appear that there would remain the sum of ₱1,505,176.30, available for appropriations for public works of a permanent character during the fiscal year 1907.

The establishment of a reserve of ₱4,000,000 is deemed to be a conservative procedure at this time, particularly in view of the fact that during the construction period of the Visayan railroads the government is liable to be called upon for the payment of interest upon the bonds issued for construction in pursuance of its guaranty, and the government should be ready to meet those demands and have a surplus to meet that and other contingencies.

It is recommended that an appropriation bill be passed providing for the construction of necessary permanent public improvements out of the apparent surplus above indicated, unless it shall be deemed more expedient to reduce taxation by a suspension of the land tax for another year or two apportion a larger percentage of the internal-revenue receipts to the municipalities and provinces.

BUDGET FOR THE CITY OF MANILA.

The revenues for the city of Manila for the fiscal year 1907, as estimated by the municipal board, as above stated, amounted to ₱2,700,000. The estimated expenditures for the city, as above stated, including some permanent improvements, provisions for sinking fund and interest on bond issues, and not including expenses of the new water supply and sewerage system provided for from the proceeds of the sale of bonds, amount to ₱3,692,884.74. The balance of the estimated appropriations for the city above the estimated income, is provided for by an appropriation from insular funds of 30 per cent of the expenditures of the city, as provided by law.

The statement of the estimated budget of the city of Manila will therefore be:

Revenues	₱2, 700, 000. 00
30 per cent of expenditures to be paid by the insular government	1, 107, 865. 42
Aggregate estimated income	3, 807, 865. 42
Total estimated appropriations	3, 692, 884. 74
Showing an apparent surplus for the operations of the year, of	114, 980. 68

The deficit at the beginning of the year, as above stated, amounted to ₱1,130,202.33. Probable deficit, June 30, 1907, ₱1,015,220.65.

FINANCIAL CONDITION OF THE PROVINCES AND MUNICIPALITIES.

The following summary shows substantially the condition of the provincial and municipal governments.

Funds which have come into the possession of the provinces and municipalities are grouped under three main divisions: (1) "Balance July 1, 1905," (2) "Revenues," and (3) "Miscellaneous receipts," totals of each division being separately shown.

Within the division "Revenues" there have been included only moneys which regularly accrue to the provinces and municipalities as revenue by general law, not including payments made to them by the insular government, either in the form of aid or loans, or on account of appropriations made by the insular government in lieu of the suspended land tax. Within the division "Miscellaneous receipts" is shown money accruing from all sources other than revenue as above defined.

Funds which have gone out of the possession of the province and the amount remaining on hand there appear in three divisions, (1) "Expenditures," (2) "Miscellaneous credits," and (3) "Balance June 30, 1906."

Within the division "Expenditures" there are included only expenditures for provincial purposes by the provincial boards. Payments to municipalities of the appropriation of revenues accruing to them, exchanges of currency, and all other items which are not provincial expenditures proper are shown under "Miscellaneous credits."

The condensed summary of provinical accounts thus segregated is as follows:

	Philippine currency.		Mexican and Spanish Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balances on hand July 1, 1905	₱1,745,737.63	₱382,143.10	₱151,803.07	₱1,211.35
Revenues	2,558,965.90	4,315,699.62	22.80	501.56
Miscellaneous receipts:				
Exchanges of currency	354,967.76	3,965.43	334,141.90	4,673.82
Other items	1,444,573.56	757,484.76		
Total debits	6,104,244.85	5,459,292.91	485,967.77	6,386.73
CREDITS.				
Expenditures	3,712,977.83		474.20	
Miscellaneous credits:				
Payments to municipalities		4,954,022.90		1,224.52
Exchanges of currency	259,269.05	3,595.19	454,483.13	5,146.61
Other items	189,392.76	7,889.45	37.30	
Balances on hand June 30, 1906	1,942,605.21	493,785.37	30,973.14	15.60
Total credits	6,104,244.85	5,459,292.91	485,967.77	6,386.73

All revenues accruing to the municipalities pass through the hands of the provincial treasurers, and when payments are made to the municipal treasurers by provincial treasurers the funds pass out of the provincial accounts and are included in the municipal statements.

The details of all receipts and expenditures of each province will be found in the auditor's report, which is hereto annexed as an exhibit. Therein are set forth the revenues and receipts and expenditures of each province and of all the municipalities.

CONCLUSION.

This report will be the last that will be presented by me as secretary of finance and justice. Such success as has attended the administration of this department during the five years of its existence is very justly attributable in large part to the loyal and efficient cooperation of the chiefs of the several bureaus and of their subordinates.

Mr. Abraham L. Lawshe has been the insular auditor since the 7th day of January, 1901. His independence, sound judgment, and strong sense of justice have been of the highest value to the insular government and of very great aid to this office.

The treasury has been under the charge of Mr. Frank A. Branagan ever since the inauguration of the bureau of the treasury under civil government. His prior experience had especially fitted him for this work, and his fidelity and efficiency are worthy of the highest commendation.

The insular customs service has been under the charge of Mr. W. Morgan Shuster since the 16th day of September, 1901. His duties have extended not merely to the port of Manila, but to a supervision of the whole work of customs collections throughout the islands. He has displayed admirable qualities as an organizer and as an administrator. Under his administration very many improvements have been made in the customs service, for which he is entitled to the chief credit.

When the bureau of internal revenue was organized Mr. John S. Hord was made collector of internal revenue, and he has filled that position ever since. He had much to do with the work of getting into proper shape the internal revenue law before his appointment to the position of collector, and has had the great burden of organizing and setting in motion a new and unpopular law. He has been most successful in his work, and the ultimate success of the internal revenue law is very largely attributable to his patience, skill, and organizing capacity.

Of Attorney-General Libbeus R. Wilfley, who has been at the head of the bureau of justice since its organization until July 16, 1906, and his successor, Señor Gregorio Araneta, I have elsewhere spoken in this report. They have both on all occasions given the best of support to this office and rendered to it every aid within their power.

Most of the principal subordinates of these officials have been, at one time or another, brought into direct relations with this office, particularly during the periods when the heads of the bureaus were absent on leave. All these subordinates have displayed the highest zeal and fidelity in the service, and most of them have demonstrated such capacity and fitness as to entitle them to promotion to the positions of heads of bureaus whenever vacancies shall arise.

The city of Manila has reported to this office only since November 1, 1905, and the administration of its officials has been commented upon elsewhere in this report.

HENRY C. IDE,
Secretary of Finance and Justice.

To the PHILIPPINE COMMISSION,
Manila, P. I.

EXHIBIT No. 1.

REPORT OF THE ATTORNEY-GENERAL.

Office of the Attorney-General,
Bureau of Justice,
Manila, August 7, 1906.

Sir: Pursuant to the provisions of Executive order No. 33, dated July 19, 1906, and the instructions contained in your letter of the same date, I have the honor to make a report upon the work of the bureau of justice for the fiscal year ended June 30, 1906.

Heretofore a report of the work of this bureau has been made for the year beginning September 1 and ending August 31, and prior to the issuance of the above-mentioned Executive order instructions had been sent out to the various branches of the bureau with a view to having the reports for this year cover the period of twelve months ending with August 31, 1906. However, the short time now allowed for completing this work makes it impracticable to submit a very full report.

THE WORK OF THE COURTS.

The statistical reports from the clerks of the courts have been made to cover the entire fiscal year ended June 30, 1906, thus including the months of July and August, 1905, which were also covered by the last annual report from this office.

I. SUPREME COURT.[a]

The following information is taken from the report of the clerk of the supreme court:

I. Number of cases pending July 1, 1905:	
Civil	405
Criminal	490
II. Number of cases filed during fiscal year ending June 30, 1906:	
Civil	326
Criminal	335
III. Number of cases decided during said period:	
Civil	252
Criminal	292
IV. Number of cases otherwise disposed of:	
Civil	54
Criminal	51
V. Number of cases pending June 30, 1906:	
Civil	425
Criminal	482
VI. Number of applicants for admission to the bar:	
Americans	8
Filipinos	78
VII. Number who passed the bar examinations:	
Americans	8
Filipinos	45
VIII. Fees received from July 1, 1905, to June 30, 1906, inclusive, Philippine currency	₱10, 157. 43

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[a] The report of the clerk of the supreme court, marked "Exhibit A," is on file in the War Department.

This report shows that on June 30, 1906, there were pending 425 civil cases and 482 criminal cases, as against 405 civil cases and 490 criminal cases on July 1, 1905. In other words, at the end of the fiscal year there were 20 more civil cases and 8 less criminal cases than on July 1, 1905.

At the end of the fiscal year, and at any other given time, there are always some pending cases in which the work of the court is finished except the preparation of the opinions, and others of the pending cases are submitted prior to the date of the clerk's report. These cases will not materially affect the totals given by the clerk in his report, because other cases are being appealed and filed during that time and are not included in the report.

The only change in the personnel of the supreme court during the past year was an addition thereto by the appointment of Hon. James F. Tracey, of Albany, N. Y., to fill the vacancy caused by the resignation of Justice McDonough in July, 1904. Justice Tracey arrived in Manila December 12, 1905, and immediately assumed the duties of his office.

Hon. E. Finley Johnson, associate justice of the supreme court, sailed for the United States in April last on leave of absence.

II. COURT OF FIRST INSTANCE OF MANILA.[a]

The report of the clerk of the court of first instance for the city of Manila shows the following statistics:

	Civil.	Criminal.	Customs appeal cases.
Number of cases pending July 1, 1905	522	124	65
Number of cases filed during year beginning July 1, 1905, and ending June 30, 1906	957	440	23
Number of cases decided during year commencing July 1, 1905, and ending June 30, 1906	536	381	30
Number of cases dismissed during year beginning July 1, 1905, and ending June 30, 1906	208	58	....
Number of cases pending June 30, 1906	735	125	58

Moneys received during the year beginning July 1, 1905, and ending June 30, 1906, as fees, fines, etc, ₱40,913.35.

This report shows that on June 30, 1906, there were pending 735 civil cases, 125 criminal cases, and 58 customs appeals cases, as against 522 civil cases, 124 criminal cases, and 65 customs appeals cases on July 1, 1905. It will thus be observed that the court of first instance for Manila has not kept pace with its business, there being on June 30, 1906, 213 more civil cases, 1 more criminal case, and 7 less customs cases than on July 1, 1905.

This report also shows the collection of ₱40,913.35 as fees and fines for the fiscal year, as against ₱24,035.96 shown by the report for the previous twelve months.

The clerk of the court makes no complaints and no recommendations as to any changes desired. The three divisions of this court appear to be working smoothly and harmoniously, and the personnel of the clerical force seems to be giving general satisfaction.

III. COURTS OF FIRST INSTANCE IN THE PROVINCES.[b]

The said table shows the following totals:

	Civil.	Criminal.
Cases pending on July 1, 1905	2,498	1,585
New cases filed up to July 1, 1906	2,052	3,888
Cases decided during same period	1,225	2,280
Cases dismissed or otherwise disposed of	770	1,922
Cases pending on July 1, 1906	2,555	1,271

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[a] The report of the clerk of the court of first instance for the city of Manila, marked "Exhibit B," is on file in the War Department.

[b] A tabulation of the work of the courts of first instance in the provinces is on file in the War Department.

In addition to the foregoing totals said table shows the collection of ₱157,685.85 in fees and fines, which added to the amount collected by the clerk of the court of first instance in Manila makes a total of ₱198,599.20 collected during the fiscal year, as against ₱115,942.40 shown by the report for last year.

The large increase in the collection of fees and fines shown by the reports from the clerks of courts is largely due to the fact that during the past year the importance of collecting the costs has been impressed upon the clerks of courts; therefore a large amount of the costs accruing from previous years has been collected during the past year and included in the amounts shown in this report.

The foregoing table is compiled from the written reports submitted by the clerks of the courts of first instance, not including the city of Manila, and is as accurate as it can be made under all the circumstances.

In considering this table and comparing it with the report for last year it will be necessary to bear in mind that the statistics of the court of first instance of Manila have been given separately.

It appears from this table that the condition of the court dockets in the provinces is much the same as in Manila—that is, the criminal cases are disposed of more promptly than the civil. This is to be commended, and it is my pleasure to state that prisoners are very rarely required to remain in jail an unreasonable time awaiting trial.

Judge John C. Sweeney, of the court of first instance of Manila, resigned, effective March 29, 1906. This vacancy was filled by the promotion of Judge Charles S. Lobingier, of the twelfth judicial district, and the vacancy thus caused in the twelfth district was filled by the promotion of Judge William F. Norris, of the fifteenth judicial district; and the vacancy thus created in the fifteenth district was filled by the appointment of Hon. José C. Abreu, effective July 1, 1906. Judge Abreu, prior to this appointment, was assistant prosecuting attorney of the city of Manila.

With the approval of the acting secretary of finance and justice, Judge Lobingier will continue on duty in the twelfth judicial district until October 1, 1906, and Judge Norris will hold court in Manila until that date.

The vacancy in the judgeship of the thirteenth judicial district, caused by the death of Hon. Warren H. Ickis on June 26, 1905, was filled on March 26, 1906, by the promotion of Hon. Ramón Avenceña, who was a judge at large prior to this appointment; and the vacancy of judge at large, caused by the promotion of Judge Avenceña, was filled by the appointment of Hon. Charles H. Smith, effective March 26, 1906. Prior to this appointment Judge Smith held the office of prosecuting attorney of the city of Manila for some three years.

The vacancy in the office of prosecuting attorney of the city of Manila, caused by the promotion of Judge Charles H. Smith, was filled by the appointment of Mr. Aylett R. Cotton, who had been engaged in the practice of law for a number of years in the city of Iloilo.

In March last Judge Wislezenus, of the eleventh judicial district, went to the United States on leave of absence, and in April Judge John S. Powell, of the fourteenth judicial district, sailed for the United States on leave. Hon. Mariano Cui, judge at large, is holding court in the eleventh district during the absence of Judge Wislezenus, and Hon. Charles H. Smith, judge at large, is holding court in the fourteenth district during the absence of Judge Powell.

On March 19, 1906, a disastrous fire occurred in the town of Tarlac, capital of the province of Tarlac, in the fourth judicial district, which destroyed the provincial building. The court of first instance for that province held its sessions in the provincial building, and Hon. Julio Llorente, judge of that district, was holding the regular term of court in that province at the time of this fire, and had with him a large number of court documents belonging to the provinces of Pampanga and Nueva Ecija, in the same district. The offices of the clerk of the court and of the provincial fiscal were also in the provincial building. All the court records of that province, as well as the documents belonging to the other two provinces named, then in possession of Judge Llorente, and the records of the provincial fiscal were burned. In order to straighten out the cases and replace as well as possible the records in pending cases, Judge Llorente held court in Tarlac during the entire court vacation period of May and June. All the information available in this office pertaining to the court of Tarlac has been furnished to the clerk of that court, and his office is again in working order.

The personnel of the courts in the provinces appears to be satisfactory, and few changes have been necessary during the past fiscal year. The increase of work in the tenth judicial district, presided over by Judge Vicente Jocson, has made necessary the employment of a Spanish stenographer to take the place of the typewriter operator formerly employed. This change was effected by an increase of only ₱220 per annum over the salary of the typewriter operator. In the fifteenth judicial district, in which Judge Abreu has succeeded Judge Norris, a Filipino stenographer, at ₱1,440 per annum, has taken the place of an American stenographer at ₱2,800 per annum.

The courts of first instance, upon the whole, appear to have kept abreast of the business, and their organization seems to be efficient and satisfactory.

IV. COURT OF LAND REGISTRATION.

This court was organized February 1, 1903. The organic act provides for one judge and one associate judge of said court. Act No. 1108 provides that any judge at large of the court of first instance may be required to perform the duties of judge of the court of land registration in any province in the Philippine Islands or in the city of Manila, and that his judgments shall be of the same validity as though he were a regular judge or associate judge of such court. Under this act Judge James Ross and Judge Mariano Cui, two of the judges at large, have spent much of their time during the past eighteen months in trying cases in the land court, and the judge and the associate judge of that court have spent all their time in the performance of their official duties.

On January 1, 1906, Mr. J. R. Wilson, clerk of the court of land registration, was appointed assistant director of lands, and was succeeded by Mr. A. K. Jones as clerk of said court.

The following is a résumé of the work of the court of land registration from its organization to July 1, 1906:

Cases filed from February 1, 1903, to September 1, 1903	144
Cases disposed of during said time	63
Cases pending September 1, 1903	81
Cases filed from September 1, 1903, to September 1, 1904	833
Total	914
Cases disposed of during the year	236
Cases pending September 1, 1904	678
Cases filed from September 1, 1904, to September 1, 1905	676
Total	1,354
Cases disposed of during the year	526
Cases pending September 1, 1905	828
Cases filed from September 1, 1905, to July 1, 1906	814
Total	1,642
Cases disposed of during same year	584
Cases pending July 1, 1906	1,058

The foregoing statement shows that whilst the court is disposing of a greater number of cases in each succeeding year, it is not keeping pace with the increase of business; every year shows a larger number of cases pending than the preceding year. As stated by the clerk of this court in his annual report, which is hereto attached, marked "Exhibit C," a knowledge of the land registration act is becoming more general, and the registers of deeds and examiners of titles are explaining the law to the people in the provinces and are assisting them in the preparation of their applications for the registration of their property. It is contemplated that the volume of business in this court will continue to increase from year to year for an indefinite time.

V. THE JUSTICE OF THE PEACE COURTS.

The law relating to these courts has been materially changed by act No. 1450, passed February 3, 1906, with a view to effecting a considerable reform in procedure, especially in criminal cases, and to reducing the hardships and opportunities for oppression.

Appointments of justices of the peace are made by the governor-general, with the advice and consent of the Philippine Commission, as before, but from lists furnished by the judge of the court of first instance of the judicial district in which the municipalities respectively are situated, instead of the lists previously furnished by the provincial board. Justices are not now required to reduce the testimony to writing in either civil or criminal cases, but must record the names of all the witnesses; and in appealed criminal cases, and when the accused in a preliminary examination is held for trial before the court of first instance, the justice of the peace is required to forward to the provincial fiscal a brief statement of the substance of the testimony of the material, important witnesses, according to his recollection.

Said act No. 1450 increases the fee of justices of the peace in criminal actions from ₱3 to ₱5, leaving the fee in civil actions as it was before, ₱3.

Prior to the passage of said act No. 1450 it was a common practice of the justices of the peace (which practice was in accordance with the law and was upheld by the supreme court) to issue warrants of arrest for persons in distant parts of the islands upon trivial charges, often based upon a desire for revenge. These warrants were usually executed by constabulary officers, and under the law they were required to deliver the prisoner to the court which issued the order of arrest. This practice caused great expense to the government in transferring prisoners thus arrested, and often caused great hardship and inconvenience to innocent people. This evil is remedied to some extent by the provisions of section 9 of act No. 1450, which prevents a warrant of arrest, subpœna or other lawful process issued by a justice of the peace being executed outside of the province in which it was issued unless indorsed by the judge of the court of first instance, or, in his absence, by the provincial fiscal, certifying that in his opinion the interest of justice requires that such warrant or process be served or executed anywhere in the Philippine Islands or within certain designated territory, as the case may be.

Said act No. 1450 also gives the judge of the court of first instance supervision over the justices of the peace within his judicial district, and makes it his duty to call a meeting of the justices of each province in his district at the provincial capital at least once in each year for the purpose of discussing questions relating to the administration of their offices and of instructing them in the performance of their duties. These meetings have already been held in some of the provinces, and it is expected that they will result beneficially to the justices of the peace and will eventually bring about a more uniform system of administration of justice in these inferior courts.

Section 77 of act No. 136 requires all justices of the peace to submit annual reports on or before February 1 of each year, covering the work done in their courts during the next preceding year.

A special effort has been made to secure these reports this year, but it has been impossible to get satisfactory results. Act No. 1450 has brought about so many changes among the justices of the peace that out of the 620 justices in the islands, outside of Manila, reports from only 157 were received. These 157 show the following figures for the calendar year 1905:

Number of civil cases filed during year	7,173
Number of civil cases disposed of during year	6,892
Number of civil cases pending on December 31, 1905	281
Number of criminal cases filed during year	7,840
Number of criminal cases disposed of during year	7,659
Number of criminal cases pending on December 31, 1905	181

Total amount of fees and fines received, ₱44,450.56.

The two Manila justice of the peace courts have jurisdiction in civil cases only. These justices have reported separately, as follows:

Justice of the peace court under Mr. José P. Quintero.

Number of civil cases pending on January 1, 1905	50
Number of civil cases filed during year	980
Number of civil cases decided during year	767
Number of civil cases otherwise disposed of during year	192
Number of civil cases pending on December 31, 1905	71

Amount of money received as fees during year 1905, ₱3,008.81.

Justice of the peace court under Mr. Pedro Ricafort.

Number of civil case pending on January 1, 1905	32
Number of civil cases filed during year	981
Number of civil cases decided during year	764
Number of civil cases otherwise disposed of during year	220
Number of civil cases pending on December 31, 1905	29

Amount of money received as fees during year 1905, ₱3,021.55.

VI. OFFICE OF THE ATTORNEY-GENERAL.

The following is a brief record of the work in the attorney-general's office for the fiscal year ending June 30, 1906:

Written opinions rendered by the attorney-general to the chief executive, heads of the four departments, chiefs of bureaus, and other officials	343
Cases in the supreme court in which this office presented briefs and arguments	385
Cases in the supreme court in which this office appeared by motion, etc	67
Cases in the court of land registration in which this office appeared and opposed registration	165
Cases in the court of land registration examined by this office, but no opposition presented	227
Petitions for pardon received during preceding year passed upon in fiscal year	82
Petitions for pardon received and passed upon in last fiscal year (discontinued this work in this office about September 1, 1905)	11
Appointments made in bureau of justice by Commission	18
Permanent appointments of employees in bureau of justice made by this office	73
Temporary appointments of employees in bureau of justice made by this office	4
Official communications written or receiving the attention of the office and disposed of other than opinions, cases, pardons, and appointments	4, 374
Requisitions made on the bureau of printing for printing and binding	527
Requisitions made on the bureau of supply for office fixtures and supplies	59

The foregoing does not show the work of this office in the administration of the estates of deceased employees of the government, because this duty was undertaken during the past year, and a statement of same is hereinafter given.

About September 1, 1905, as noted above, by direction of the governor-general, this office was relieved of the duty of securing data and making recommendations upon petitions for pardon. The pressure of work in this office was also somewhat relieved by the executive bureau undertaking the duty of passing upon questions submitted by municipal officials.

ADMINISTRATION OF ESTATES OF DECEASED EMPLOYEES.

Act No. 290 of the Philippine Commission provides for "an inexpensive method of administration upon the estates of civilian employees who are citizens of the United States and who die in the service of the insular government, leaving small estates upon which no regular administration is deemed advisable," and provides that the insular treasurer shall administer such estates.

Said act No. 290 was amended by act No. 1041 by "providing a method of paying small amounts due estates of deceased native employees without the expense of administration."

Act No. 1407, section 18, provides that the attorney-general shall perform the duties and render the services prescribed for the insular treasurer by act No. 290, as amended. It further provides that whenever any civilian employee who is a citizen of the United States in the service of the government of the Philippine Islands, or any branch thereof, shall die in that service leaving real property or real and personal property in the Philippine Islands, the entire value of which does not exceed ₱1,500, and no regular administration in accordance with the provisions of the code of civil procedure shall have been had, the attorney-general is authorized, and it is made his duty, to take possession of the estate of such deceased person. He is required to make a complete inventory thereof, to file the same with the auditor, and as to such estates to perform all the duties prescribed and render all services required by act No. 290 of the treasurer of the Philippine Islands as to estates of deceased civilian employees no part of which is real property. He is also required to settle the estates of deceased civilian employees of which real estate is a part in the same manner as the treasurer of the Philippine Islands now settles estates of deceased civilian employees of which real estate is not a part.

The attorney-general did not take charge of this work under the provisions of act No. 1407 until December 1, 1905. Under these laws he ascertains, by the best means within his power, the names and addresses of any and all persons lawfully entitled to any such estate and transmits the estates, or the proceeds thereof, to the lawful owners, after paying funeral expenses and such other debts and expenses as he may deem just.

The total number of estates administered under the provisions of act No. 290 and its amendments to July 1, 1905, was 229; since that date 46 estates have been administered, making a total of 275. There are now 57 estates pending settlement.

The following statement shows the balance on hand July 1, 1905, the receipts and disbursements during the past fiscal year, and the balance on hand July 1, 1906:

Balance on hand July 1, 1905	₱7, 661. 05
Receipts from July 1, 1905, to July 1, 1906	23, 001. 00
Total	30, 662. 05
Disbursements from July 1, 1905, to July 1, 1906	22, 106. 71
Balance on hand July 1, 1906	8, 555. 34
Total	30, 662. 05

Delay is sometimes caused in the settlement of these estates by not being able to locate the relatives or because of the fact that the decedents had property or money accountability as employees of the government and the insular auditor requires time to determine the status of the accounts. In all cases it is deemed advisable to hold the settlement of an estate open for a reasonable time in order to give creditors an opportunity to file their claims.

CHANGES IN THE OFFICE.

Mr. Fernando Salas, assistant attorney, resigned July 31, 1905, and was succeeded by Mr. Jovito Yusay, of Iloilo.

Mr. Carter D. Johnston, who had been disbursing officer for the bureau of justice since January 1, 1902, was, on November 1, 1905, appointed assistant attorney in this office, and the position of disbursing officer was abolished.

Mr. Walter F. Wood, assistant attorney, died of cholera on January 5, 1906, and was succeeded by Mr. Isaac Adams by transfer from the bureau of education on January 24, 1906.

Mr. Samuel P. Walker, assistant attorney, resigned on February 4, 1906, and was succeeded by Mr. Alexander S. Lanier, of Richmond, Va., who was appointed March 16, 1906, and arrived in the islands and reported for duty on April 25, 1906.

Hon. Libbeus R. Wilfley resigned the position of attorney-general for the Philippine Islands on July 15, 1906, to accept an appointment as judge of the United States court in China, and the undersigned was appointed his successor. Mr. Wilfley had been attorney-general for the Philippine Islands since the organization of civil government, and the undersigned had held during the same time the position of solicitor-general.

Miss Floy V. Gilmore, assistant attorney, resigned July 17, 1906, and her resignation has been accepted, to be effective October 24, 1906.

EXPENSES OF WITNESSES IN CRIMINAL CASES.

In conclusion I desire to call your special attention to the important question of the expenses of witnesses in attending the courts of first instance in criminal cases.

The necessity for making some provision for the payment of witness fees or the expenses of witnesses in criminal cases has been often called to the attention of this office. At the present time there is no authority of law for the payment of such fees or expenses, and no payments of this character are made except such as are made by the governor-general from the contingent funds in his hands in cases that are considered special and exceptional.

The question received the attention of the auditor, the attorney-general, and the secretary of finance and justice in the early part of 1903, and the result of the ruling of the auditor was that the expenses of witnesses who are employees of the insular or provincial governments will be paid as ordinary expenses of travel under orders by the bureau or province in which the witness is an employee, provided that the necessity for such a person appearing as a witness is due to the fact that he is an employee of such bureau or province, and that the expenses of witnesses who are not employees of the insular or of provincial governments can only be paid in exceptional and meritorious cases by the governor-general out of the contingent funds in his hands for disbursement within his discretion.

As an illustration of the hardships that are inflicted upon people who are required to attend court as witnesses in criminal cases, it may be stated that in one instance a man who was an employee of the insular government in the years 1904 and 1905, while on duty in the province of Laguna, obtained certain information which resulted in the arrest and prosecution of another government employee. The man who reported these facts, and who was the principal witness in the case, resigned from the service of the insular government, leaving the province of Laguna and taking up his residence in the province of Albay. A year or more after the case was filed it was brought to trial, and this witness in the province of Albay was summoned to appear before the court of first instance in Santa Cruz, Laguna, as a witness in the case. The witness only possessed sufficient funds to pay his expenses from Albay to Santa Cruz, Laguna, and upon arrival in Manila reported the facts to this office and asked for the money to pay his expenses. The same were paid out of said funds in the hands of the governor-general.

In this case the witness was an American, a former employee of the government, who knew the steps necessary to be taken in order to protect himself against loss. An American or a native ignorant of the means through which he might secure return of his expenses might have been compelled to bear the loss of the time and money necessary in obeying the process of the court, and thenceforth would have felt some resentment against the government and would, if possible, avoid giving any information in the future that might make it necessary for him to be called before the court as a witness.

The attorney-general, in his annual report for the year 1904, referred to this matter in the following language:

"This system was in vogue during the Spanish time and the law on the subject has not been changed under American rule. The result is, the people look upon it as a continuation of one of the abuses of the old régime. It can not but have a detrimental effect upon the entire administration of justice throughout the archipelago. It results in prejudicing the people against the government generally and against the courts in particular, in addition to placing a serious obstacle in the way of efficient administration of justice. This is not fair to the people, and we should not deceive ourselves by believing that they do not have a full recognition and appreciation of the fact. Furthermore, on account of the hardship and injustice resulting from this practice, many good people will not make known to the government officials many criminal acts which come within their observation. Far from giving information and offering assistance to the government in the work of apprehending and punishing criminals, there is a marked disposition to conceal a knowledge of criminal acts and to evade the processes of the court, on account of the hardships and injustices to which they are subjected by the above-mentioned practice."

I concur in these observations made by my predecessor, and believe that it is necessary to make some general provision by which witnesses may at least be reimbursed for actual necessary expenses incurred in attending the courts of first instance as witnesses in criminal cases.

Respectfully submitted.

Gregorio Araneta,
Attorney-General.

Hon. Henry C. Ide,
Acting Secretary of Finance and Justice, Manila, P. I.

Note.—The following exhibits are on file in the War Department: Exhibit A, report of the clerk of the supreme court; Exhibit B, report of the clerk of the court of the first instance.

EXHIBIT C.

COURT OF LAND REGISTRATION OF THE PHILIPPINE ISLANDS,
Manila, P. I., August 29, 1906.

SIR: In compliance with the instructions contained in your letter of August 27, 1906, I have the honor to submit the following report of the work of this court for the period from July 1, 1905, to June 30, 1906:

The land-registration act of the Philippine Islands became effective February 1, 1903, and has now been in operation about three and one-half years. The court was organized with Hon. Simplicio del Rosario, judge; Hon. D. R. Williams, associate judge, and Mr. J. R. Wilson, clerk. Hon. D. R. Williams having resigned, was succeeded by Hon. W. L. Goldsborough in April, 1905; also Mr. Wilson having been appointed assistant director of lands and succeeded as clerk by the undersigned in January, 1906, leave the personnel at present to consist of Hon. Simplicio del Rosario as judge, Hon. W. L. Goldsborough, associate judge, and A. K. Jones, clerk.

During the period covered by this report the business of the court has steadily increased. Up to July 1, 1905, the total number of applications filed was 1,547, while the total number on July 1, 1906, was 2,467, showing the total of 920 received during the year, an average of over 76 cases per month. This increase may be ascribed to several causes:

First. That a knowledge of the land-registration act is becoming more general.

Second. That on account of lands set apart as civil and military reservations, which are comparatively few, it has been obligatory upon the people having interests therein to register their titles.

Third. That the registers of deeds and examiners of titles explain the law and assist the property holders in the preparation of their applications for presentation to the court.

Fourth. That the sessions of the court have been more numerous, and held, to the great encouragement of the property owners, in nearly every province under its jurisdiction:

Albay	18
Ambos Camarines	13
Bataan	5
Batangas	2
Benguet	6
Bulacan	34
Cagayan	25
Capiz	1
Cavite	9
Cebu	11
Ilocos Norte	4
Ilocos Sur	1
Iloilo	38
Isabela	3
Laguna	18
Leyte	74
Masbate	2
Manila	290
Mindoro	4
Moro	16
Negros Occidental	42
Nueva Ecija	20
Pampanga	45
Pangasinan	49
Paragua	1
Rizal	59
Samar	7
Sorsogon	66
Tarlac	17
Tayabas	9
Union	1
Zambales	22

The value of the property represented in the above applications amounts to nearly ₱11,000,000, making a total value as represented in all applications received since the organization of the court of about ₱30,000,000.

Included among the applications presented are some very large estates, principal among which are the Hacienda de Maricaban, the Tanduay estate, the Consuelo Roxas estate, and others.

Following is a statement of the cases considered by the court during the period mentioned:

Number of sessions:	
Manila	189
Provinces	103
Total	292
Cases decreed:	
Final	594
Pending appeal	35
Appealed	16

Cases denied:	
Final	33
Pending appeal	2
Appealed	4
Cases withdrawn	29
Cases pending	1,058
Total	1,771
Cases previously disposed of	696
Total	2,467
Cases opposed	149
Number of written oppositions	160
Number of persons included in	317

In addition to the cases decreed, many others were set for hearing, but were continued pending further evidence of title, amendments to petition, plans, etc.[a]

The constant effort of my predecessor, assisted by the judges, to bring to the attention and knowledge of the public the advantages to be derived from registering their lands in this court is now beginning to bear fruit, and while, with the assistance of two first instance judges, the court has not been able to dispose of its business as speedily as might have been desired, the failure is due very much to said judges having to be recalled for first instance duty. This, with the lack of competent surveyors, are the main causes for delay in the disposition of cases presented to this court.

In the former case it might be proposed that the court avail itself of the provisions of law authorizing the appointment of referees to take testimony. This method has been tried but has not proven satisfactory, although the court, on account of the pressure of business, still has to resort to it.

In the latter case, as recently suggested by the governor-general, the question of surveyors has been taken up with the bureau of lands, through whose system it is hoped the needs in this particular will be met in the near future.

With these conditions remedied the court would be enabled to dispose of the business with greater dispatch, offering to the people still greater encouragement to register their lands.

During the year covered by this report a number of changes have taken place among the registers of deeds. Under authority of the governor-general, for the purpose of economy, the offices of thirteen regularly appointed registers were abolished and the duties thereof taken over and performed by the respective provincial treasurers. Now there remains throughout the provinces and including the city of Manila 9 regularly appointed registers of deeds, 29 provincial treasurers, acting registers of deeds, and 28 provincial fiscals, acting examiners of titles, who are provided with all the necessary forms and instructions, and are prepared in every way, as far as their other provincial duties will permit, to instruct the people and to assist them in presenting their petitions to the court.

Respectfully submitted.

A. K. JONES,
Clerk of the Court.

The ATTORNEY-GENERAL FOR THE PHILIPPINE ISLANDS.

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[a] List of places where adjourned sessions were held is on file in the War Department.

EXHIBIT No. 2.

REPORT OF THE INSULAR COLLECTOR OF CUSTOMS.

OFFICE OF THE INSULAR COLLECTOR OF CUSTOMS,
Manila, August 10, 1906.

SIR: In accordance with your instructions of July 19, 1906, I have to submit herewith my fifth special report of the operations of the Philippine customs service, from July 1, 1905, to June 30, 1906, to accompany the fifth annual report of the department of finance and justice.

Respectfully,
W. MORGAN SHUSTER,
Insular Collector of Customs.

Hon. HENRY C. IDE,
Governor-General of the Philippine Islands, Manila.

FIFTH SPECIAL REPORT.

MANILA, *August 10, 1906.*

SIR: The following special report, which will be the fifth consecutive one prepared by the undersigned, marks a departure in that it deals principally with the transactions for the fiscal year 1906, or the exact period from July 1, 1905, to June 30, 1906, inclusive. In accordance with instructions, no supplemental statements are appended, as has been the custom previously.

As a matter of interest to those studying the commerce of the islands, the statistical tables, prepared in a manner for ready reference, will embrace the entire period of American occupation to the close of the last fiscal year.

Brief comment is made herein on the legislation enacted during the past fiscal year relating to the customs service, and on the more important regulations which have been issued to meet the administrative needs of the bureau.

ABOLISHMENT OF POSITIONS AS SPECIAL AGENTS.

The appropriation act (No. 1416) for the fiscal year ended June 30, 1906, made no provision for salaries of customs special agents formerly engaged in checking the accounts of the various bonded customs officials at Manila and the several outside ports and in performing, under the direction of the insular collector, other work along the line of preventing frauds on the customs revenue.

This change in system was anticipated, and the necessary rearrangement of the customs personnel was accomplished. The work heretofore devolving upon the special agents is now being performed by a corps of district auditors created under the provisions of the accounting act (No. 1402), who operate under the direct supervision of the insular auditor.

Act No. 1416 made it incumbent to perform the duties of this bureau with a considerably decreased force.

REDUCTION OF MARINE LICENSE FEES.

By act No. 1387, passed September 5, 1905, a rearrangement and reduction of the marine license tax was made, as follows:

"(*a*) For vessels propelled by steam or other mechanical motive power, ₱1.50, Philippine currency, per net registered ton.

"(*b*) For sailing vessels and vessels not propelled by steam or other mechanical motive power, ₱1, Philippine currency, per net registered ton."

(*c*) For vessels engaged exclusively in the lighterage and harbor business, ₱1 Philippine currency per net registered ton.

This legislation has reduced, as expected, the aggregate amount of revenue derived from this source, inasmuch as the previous annual license tax on vessels engaged in the general coastwise trade was $1 gold per net registered ton, and the same amount for each gross ton on craft engaged in the lighterage and harbor work. It is believed, however, that the reduction, under the circumstances, was justified, in view of the somewhat depressed condition of shipping interests throughout the islands.

Attention is invited to the tabulated statement subsequent hereto showing corresponding collections, under the head of "Annual license fees for the two fiscal years last past."

On October 13, 1905, the Commission passed act No. 1405, by the terms of which the court of customs appeals was abolished and the powers and duties of that court transferred to the court of first instance of the city of Manila.

REORGANIZATION ACT, NO. 1407.

This law made certain changes in the personnel of the customs service, the most important of which was the abolishment of the positions of disbursing officer and of one additional deputy collector of customs.

On November 17, 1905, act No. 1411 was enacted, prohibiting the exportation of Philippine silver coins or bullion made from such coins. The work of enforcing this law devolved upon the customs service, and the necessary instructions were promptly issued to the several collectors of customs. Through the cooperation of the office of the insular treasurer, information has been received in advance as to intended exportations, and the necessary steps taken to prevent violations of the law mentioned.

On January 3, 1906, by act No. 1432, the net income arising from the operating of the customs tramway or "arrastre" plant on the wharf at Jolo was transferred to the government of the Moro Province.

By the provisions of act No. 1436, enacted January 9, 1906, the committee created by act No. 243, to have charge of the collection of funds for the Rizal monument and for the erection of said monument, was, on the recommendation of this office, declared to be a branch of the insular government, and the figures, stone, and other necessary materials so imported by the committee were granted free entry under paragraph 385 of the tariff-revision law of 1905.

Act No. 1480, enacted April 24, 1906, amending the provisions of section 311 of the Philippine customs administrative act, as amended by section 16, act No. 1235, provides for an alternative penalty of imprisonment not exceeding six months in cases of conviction for offenses named in said section.

By act No. 1499, passed May 29, 1906, it was made unlawful to use dynamite, other explosives, or poisonous substances in the taking of fish. As was pointed out in the fourth special report of this office, the importance of the fishing industry in the Bay of Manila is but little appreciated by the general public, and offers an inviting field for increased gains in the material wealth of the islands. In this respect a comparison may be made with Japan, whose waters not only afford sufficient fish which constitute one of the principal foods for its people, but likewise a source of great revenue to the country. The deep-sea fish caught in the Bay of Manila compare most favorably with fish of other countries of the Orient.

OPIUM LAW.

A law passed for the purpose of controlling the opium traffic, act No. 1461, passed March 8, providing for the collection of an internal-revenue tax on imported opium, requires the cooperation of this bureau with that of the bureau of internal revenue. Arrangements similar to those promulgated under the provisions of section 108 of act No. 1189 (internal-revenue law) were published, to the end that imported opium may be held in customs custody until the internal-revenue formalities of the opium law are complied with.

Comment will be made in another part of this report relative to opium importations, and at this place it is thought well to point out that the internal-revenue tax on opium, which is all imported, in reality means an increased tax which must be paid before the merchandise is released from the customs. This may explain to a certain extent the decrease in the opium importations, it being possible that the increased taxation has induced Chinese and others to resort to the smuggling of this very valuable article, thus depriving the government of revenue.

PORT OF MANILA.

No revival in commercial circles was had during the past fiscal year, for which reason business conditions at the port of Manila have been considerably depressed. It is quite evident that no surplus stocks of merchandise have been imported and that only such orders were placed as were necessary to meet the existing demands. The importation of rice continues to decrease, which fact, of course, is a source for congratulation. Rice and opium are the two articles which show the greatest reduction in importations, and the loss of import revenue over that of the corresponding preceding period is accounted for to a large extent by the decreased importations of the two articles above named.

DRAWBACK REGULATIONS.

Pursuant to the provisions of section 23 of the tariff revision law of 1905, and with the approval of the governor-general, there were promulgated October 21, 1905, complete regulations covering drawbacks on articles manufactured or produced in the Philippine Islands from imported materials. With slight modifications the regulations follow those in force in the United States, where the drawback system has long been recognized as a means for the encouragement of the export trade in domestic manufactures and in animal products.

Indications seem to be that the time is not yet ripe for the extensive use of the drawback provision in the Philippine Islands, in view of the scarcity of manufacturing industries.

The fiscal year just closed saw but two transactions under this head. These were in each instance entries for trimmed straw hats. Drawback was allowed on the various articles used in the manufacture of the completed hat—that is, straw braids, blue hat leathers, silk cords, and silk hat linings. The total amount of drawback approved was $7.44 and $6.22, respectively, aggregating $13.66.

TONNAGE DUES.

This office deems it proper to repeat in this report its recommendation that previously, on March 22, 1906, in regard to the abolishment of tonnage dues now charged on foreign vessels entering these islands. Said recommendation was as follows:

"This office has no hesitancy in stating, as it has always stated, that if the revenue at present derived from the collection of tonnage dues can be dispensed with by the government of the Philippine Islands, all tonnage dues on vessels entering ports in these islands should be promptly removed. If a part only of the present revenue derived from this source can be dispensed with by the government, so much of the tonnage dues as produce that part should be promptly removed. This is not a question of customs administration, but is purely an economic one, as to which the government officers charged with the entire scheme of taxation and government expenditures in these islands are, of course, best qualified to speak. There is no question involved in the imposition of these tonnage dues except that of revenue.

"For the information of the Philippine Commission, it may be stated that the tonnage dues collected under section 14 of the tariff revision law of 1901 and the tariff revision law of 1905, respectively, during the period from January 1, 1902, to December 31, 1905, have been as follows:

Calendar year—	
1902	$61,109.21
1903	70,058.24
1904	70,641.36
1905	62,587.88
Total	264,396.69

* * * * * * *

"In conclusion, this office will state that, if it be deemed possible to dispense with all of the revenue now collected as tonnage dues, it is considered that the same will have a beneficial tendency on foreign commerce at this port."

COASTWISE FEES.

The practical effect of acts Nos. 1341 and 1354, relating to the coastwise trade and abolishing the license fees for small craft under 15 tons gross burden, respectively, as mentioned in the preceding special report of this office, has demonstrated the wisdom of the policy adopted.

PORT OF JURATA.

As pointed out in the fourth special report of this office, it was not to be expected that the government would derive any considerable revenue from the source of customs receipts at the port of Jurata, and the statistics at hand for the last fiscal year bear out this idea. The gross customs collections for the year were $1,128.89 gold.

PORT OF SITANKI.

By act No. 1454, passed February 15, 1906, the port of Sitanki, lying in the Tawi-Tawi group of small islands, of the Jolo collection district, was created an entry port for the purpose of meeting the exigencies of the service similar to those surrounding trade at Jurata. The undersigned, during a tour made of the southern islands in the month of January, 1906, was able to confirm previous reports as to the importance of the location at Sitanki as a place for the government to exercise its efforts toward checking smuggling into the southern islands from the neighboring ports on the island of Borneo. The real good that Sitanki may do will not be shown by the amount of revenue which it may collect, but the maintenance of an entry port at that place, in charge of a competent customs official, will, it is thought, exert a deterrent influence over the unlawful operations of those Moros and others who seek to evade the revenue laws.

A customs office for the port of Sitanki was established on a small island lying about 500 feet south of the island of Sitanki. This island is only 250 feet long by 150 feet wide, and some of the difficulties and hardships of maintaining customs supervision at such a post, on the outer edge of civilization, may be imagined when it is stated that there is no supply of fresh water nearer than 4 miles, on a neighboring island. With the exception of cocoanuts, nothing whatever is produced in that vicinity suitable for human food, and all supplies in quantities to last for a period of from sixty to ninety days must be transported thither in government vessels. In the past Sitanki has been a distributing point of more or less importance for certain commodities, undoubtedly smuggled in and subsequently disposed of to the people of the neighboring islands in the southern waters. A significant feature of the trade conditions at Sitanki is suggested by a recital of the fact that, at the present time, of the 300 inhabitants thereat 50 are Chinese, who control and conduct the business of the place. The Moros are reported to be densely ignorant and possibly of a lower type than members of the same race who inhabit the more prosperous islands to the north.

With the system of the customs service better organized at this place, it is believed that effective measures can be taken to stop, to a certain extent, the heretofore uninterrupted alleged practice of landing contraband goods and merchandise from Borneo into the southern islands through the port of Sitanki.

GOVERNMENT COALING STATIONS.

Pursuant to the terms of Executive Order No. 23, promulgated May 9, 1906, this office received the transfer from the insular purchasing agent of all the equipment and stock pertaining to the service of the coal supply of the Philippine government at ports in the Philippine Islands outside of Manila. The additional responsibility and detail work imposed upon this office has been considerable.

At the present time equipped stations are maintained at Iloilo, Cebu, Bongao, Zamboanga, Jolo, Aparri, Tacloban, Puerto Princesa, Romblon, Dumaguete, and Lucena. These stations, with the exception of the latter five, are in charge of responsible customs officers. Owing to the impossibility of securing the services of any responsible person to handle the coal piles at Capiz, Surigao, Escalante, and Ormoc, and the slight demand for coal at those stations, it has been decided to abandon them as such; and the abandonment of the stations at Dumaguete and Lucena is contemplated as soon as some satisfactory disposition can be made of the coal on hand there.

Coal is furnished at all regularly established stations upon the written order of the master of any insular or provincial vessel or of any insular or provincial officer requiring the same for official purposes. The coal so used is charged to the bureau, department, or office receiving the same, and the cost price thereof. together with a surcharge sufficient to cover unavoidable waste and the necessary expenses incident to the maintenance and operation of the service, is collected. Provision is made that the surcharge imposed shall not exceed 15 per cent of the original cost of the coal as laid down at the station, except upon the previous approval of the secretary of finance and justice. From the experience gained after operating this service since the 1st of May it would seem that the surcharge of 15 per cent covers amply the cost of the coal delivered on board the receiving vessels. This feature is now being carefully studied with the view of cutting down expenses to a minimum.

AMENDMENT TO TARIFF.

Among the important pieces of legislation affecting the Philippine customs service during the past fiscal year was that enacted by Congress on February 26, amending paragraphs 117, 118, 119, 120, and 123 of the cotton schedule, paragraphs 223 and 225 of the shoe schedule, and paragraph 402, relating to export duties, of the tariff revision law of 1905. New rules were adopted providing for 100 per cent surtax on all cotton textiles having false selvage, and prescribing that the term "false selvage" shall be understood to be an edge "obtained by cutting, ripping, or tearing, or otherwise splitting the textile in the direction of the warp."

GROSS CUSTOMS RECEIPTS.

The total customs collections from all sources throughout the islands for the fiscal year ended June 30, 1906, aggregated $7,553,090.95 gold—a decrease of $710,353.30, or 8⅗ per cent, as compared with the previous fiscal year, when the aggregate customs collections were $8,263,444.25. For the same periods the total customs expenditures were $520,278.87 and $439,103.23, respectively, a decrease of $81,175,64, or 15⅘ per cent in favor of the fiscal year ended June 30, 1906, and, compared with the fiscal year of 1904, the decrease in expense represents 22¼ per cent.

As the total customs collections include the item of refundable export duties paid on hemp shipped to the United States, and this amount for the last fiscal year was $433,991.79, as against $486,575.56 for the corresponding period, or a decrease of $52,583.77, this latter amount may be in reality considered a gain to the net receipts.

The explanation of the net decrease in revenues is found in the falling off of receipts from four sources—opium, rice, beer, whisky, and spirituous liquors—and equipment of the plant of the Manila Electric Railway and Light Company, as the tables following will show:

Opium imported.

Fiscal year.	Pounds.	Value.	Duty.
1904	249,770	$770.596	$338,422
1905	268,128	850,381	366,893
1906	150,281	440,424	272,955

The decrease in quantity of opium imported is more than 40 per cent, and in value nearly 50 per cent, and notwithstanding the greatly increased rate of duty, the loss to revenues on account of reduction in the amount of duty collected on opium aggregates $93,938 United States currency.

Rice imported.

Fiscal year.	Pounds.	Value.	Duty.
1904	727,124,332	$11,548,814	$1,650,720
1905	563,282,346	7,456,738	1,311,496
1906	302,211,300	4,371,982	1,047,521

Decrease of duty on rice, 1906	$263,980
Decrease of duty on opium, 1906	93,938
Decrease of duty on street-railway equipment	65,000
Total	422,918

During the fiscal year 1905 the Manila Electric Railway and Light Company, which established a street-railway system in Manila, imported materials and supplies upon which a large amount of import duties was collected. An equal amount of revenue was of course not realized during the last fiscal year before the beginning of which the plant in question had been fully equipped and put in operation, and a reduction of import revenues amounting to $65,000 occurred from this cause.

DUTIES PAID BY INSULAR GOVERNMENT.

Customs collections for the last fiscal year were not inflated by reason of payments on the part of the insular government, as is revealed in the statement that, for the past fiscal year, such collections amounted to but $167.41, as against $23,581.99 for the corresponding period preceding. The operation of act No. 1230 accounts for the change.

DECREASE OF LICENSE FEES COLLECTED.

In considering these statistics the fact should be remembered that by a decided change in the legislation the annual license fees for steam vessels were reduced one-fourth; for sail vessels of all descriptions, one-half; and for craft engaged in the lighterage and harbor business, one-half. Special licenses were discontinued altogether, and no revenue was collected from this source; furthermore, a very considerable number of vessels were placed out of commission owing to lack of business.

The foregoing, it is believed, explains why the collections of license fees during the fiscal year 1906 were but little more than one-half of those of the preceding year, as shown by the following table:

Comparative statement of annual license fees collected for vessels, also showing decrease resulting from operation of acts Nos. 1354 and 1387, fiscal year 1906, Manila collection district.

Month.	Fees collected, fiscal year 1905.	Fiscal year 1906.			
		Fees collected.	Refund.	Net collection.	Decrease.
July	₱5,687.90	₱4,016.13	₱676.48	₱3,339.65	₱2,348.25
August	10,396.60	5,231.55	1,325.28	3,906.27	6,490.33
September	5,644.05	3,163.00	413.99	2,749.01	2,895.04
October	2,312.24	1,959.25		1,959.25	352.99
November	8,632.37	3,917.04		3,917.04	4,715.33
December	10,658.43	3,723.79		3,723.79	6,934.64
January	62,441.13	36,170.21		36,170.21	26,270.92
February	19,413.53	10,930.16		10,930.16	8,483.37
March	13,408.40	5,386.66		5,386.66	8,021.74
April	9,350.05	4,684.00		4,684.00	4,666.05
May	7,230.93	3,535.88		3,535.88	3,695.05
June	8,361.95	3,019.06		3,019.06	5,342.89
Total	163,537.58	85,736.73	2,415.75	83,320.98	80,216.60

EXPLANATORY NOTES.

Special license abolished by act No. 1354.
Steam vessels, coastwise trade, licenses reduced 25 per cent by act No. 1387.
Sail vessels, coastwise trade, licenses reduced 50 per cent by act No. 1387.
Steam vessels, lighterage and harbor, licenses reduced 50 per cent by act No. 1387.
Sail vessels (not decked over), lighterage and harbor, licenses reduced 50 per cent by act No. 1387.
Fees for lighterage and harbor licenses were further reduced by the provision in act No. 1387 that same be computed on the net instead of the gross registered tonnage.
An increased number of vessels placed out of commission.

PORTS OF ILOILO AND CEBU.

The gross customs collections at the ports of Iloilo and Cebu, respectively, for the past fiscal year and for the two similar periods preceding, as a matter for comparison, are given herewith:

Fiscal year.	Iloilo.	Cebu.
1904	$604,652.27	$634,817.03
1905	531,266.01	782,787.59
1906	585,329.82	644,212.45
Total	1,721,248.10	2,061,817.07

From the foregoing statistics it will be seen that while the customs business at Iloilo for the fiscal year 1906 shows a substantial increase over that of the corresponding period preceding, a marked decline in customs revenue is reported from Cebu, the difference, or reduction, between the fiscal years 1906 and 1905 amounting to $138,575.14. In this connection, however, it should be made a matter of record that the collections for the fiscal year 1905 were abnormally large for reasons pointed out in the fourth special report of this office. As the figures for the past fiscal year are slightly larger than those for the fiscal year 1904, it is correct to state that returns from Cebu are considered very favorable indeed, especially in view of the depression commerce has suffered throughout the island of Cebu by the prevalence of a severe drought during a considerable portion of the fiscal year ended June 30, 1906.

PORTS OF ZAMBOANGA AND JOLO.

The gross customs collections at the ports of Zamboanga and Jolo for the last three fiscal years were:

Fiscal year.	Zamboanga.	Jolo.
1904	$41,120.20	$76,076.05
1905	54,359.93	75,300.28
1906	89,409.48	67,214.89
Total	184,889.61	218,591.22

To Zamboanga, therefore, belongs the credit of being the banner port in the Philippine Islands in the matter of increase in customs collections. The growth of business at this place has been steady and continuous and gives encouraging signs for the future. As noted in the last report submitted by the undersigned, improved trade conditions exist at the port of Zamboanga, and from the encouraging reports received relative to the industry and development now noticeable in various parts of the island of Mindanao it is evident that the improvement will be permanent and of a very substantial nature.

PORTS OF BONGAO AND BALABAC.

Small returns were realized in the aggregate customs collections at the respective ports of Bongao and Balabac. The tables are as follows for the three fiscal years last past:

Fiscal year.	Bongao.	Balabac.
1904	$1,223.00	$743.39
1905	1,552.54	3,267.12
1906	1,456.81	3,825.94
Total	4,232.35	7,836.45

PORTS OF JURATA AND SITANKI.

Both the ports named above were established and opened for business after the commencement of the last fiscal year. The returns from Jurata, amounting to $1,128.89, are considered quite satisfactory, due account being taken of the local conditions.

HARBOR REGULATIONS.

The most important customs administrative circular promulgated during the year was No. 397 of February 19, 1906, containing regulations governing vessels in the various ports of the Philippine Islands, and defining the limits of the ports of entry. By the provisions of section 16 of act No. 1235 of the Philippine Commission, these regulations took the form of law with appropriate penalties, after receiving the approval of the honorable the secretary of finance and justice and being published at least once in the Official Gazette. These regulations have done much to improve the conditions of river and bay traffic throughout the different ports of the islands.

EXPORTS.

The total value of exports, currency excluded, for the last fiscal year was $31,918,380; for the corresponding period preceding, $32,355,865; or a decrease for the year just closed of $437,485.

The following table will show at a glance wherein the loss to the export trade occurred, and, furthermore, affords interesting data with reference to the four chief products of the Philippine Islands, to wit, hemp, sugar, copra, and tobacco.

The great loss in hemp has been elsewhere referred to in this report. On the other hand, copra made a most gratifying gain, so much so that the increase realized in the value of copra and tobacco almost offsets the loss sustained in hemp and sugar.

Hemp shows loss	$2,699,472
Sugar shows loss	113,161
Total decrease in value of exported hemp and sugar	2,812,633
Copra shows increase	1,948,693
Tobacco shows increase	393,852
Total increase in value of exports of two products	2,342,545
Decrease in the four chief products of export named above	470,088

The proportion of sugar and tobacco, the two items about which the agitation for the reduction of the tariff in the United States has centered principally, is indicated by the following condensed tables, from which it will be seen that practically no Philippine sugar found a market in the United States, while the showing for tobacco, on which the United States duty is relatively much greater, is correspondingly less:

Sugar exported.

	1905.	1906.
All countries	$4,977,026	$4,863,865
United States	2,618,487	260,104

Tobacco, and manufactures of, exportation of, fiscal year 1906.

Article.	All countries.		United States.	
	Quantity.	Value.	Quantity.	Value.
Leaf tobacco .... pounds..	21,359,892	$1,458,658	107,923	$6,143
Cigars .... thousands..	93,136	904,250	1,288	23,405
Cigarettes .... do....	18,892	16,801	126	88
All other manufactures .... pounds..	110,453	10,181	2,197	1,367

Tobacco exports, recapitulated.

All countries	$2,389,890
United States	31,003

IMMIGRATION.

The following table shows the numbers, by nationalities, of passengers arriving at and departing from all ports in the Philippines during the fiscal year 1906. A significant feature to be pointed out is the great decrease of Japanese immigration as compared with previous years, 1,235 having arrived in the fiscal year of 1905, while only 277 of that nationality came to the islands in the year 1906, a decline of 77½ per cent. That the tendency of Japanese immigration is not toward these islands is emphasized by the statistics, which reveal the departure of 371 Japanese during the year, while only 277 came to these shores:

Nationality.	Immigration.	Emigration.	Nationality.	Immigration.	Emigration.
Americans	7,647	1,833	Japanese	277	371
Filipinos	693	587	Cuban	5	1
Spaniards	580	450	Irish	15	2
Germans	89	75	Portuguese	24	47
Chinese	7,966	6,719	Polish	....	2
English	430	414	Scotch	34	3
French	75	59	All other	351	336
Scandinavian	10	17			
East Indians	84	82	Total	18,293	11,013
Russian	13	15			

NOTE.—The above total of Americans includes officers and enlisted men of the Army, Navy, and Marine Corps, and trained army nurses, passengers arriving by transports prior to January 1, 1906, since which date such arrivals are not included in the statistical returns of passengers, pursuant to instructions received from the Bureau of Insular Affairs, War Department, Washington.

Comparative statement of Chinese and Japanese immigration.

Fiscal year.	Number of immigrants.	
	Chinese.	Japanese.
1903	8,762	1,072
1904	9,089	2,744
1905	8,886	1,235
1906	7,966	277

ARRASTRE PLANT.

The arrastre plant at the Manila custom-house has continued in successful operation during the past fiscal year.

The same rates which were put in force on July 1, 1904, have been continued. The proportion of merchandise stored on and delivered from the wharf has been greater than in the previous years, and, as shown by the figures below, this proportion has increased from 32.7 per cent in the last half of the fiscal year 1905 to 39.6 per cent for the same period of 1906. Certain improvements and repairs have been made to the plant and warehouses for the better handling and protection of imported merchandise. "Media-aguas" have been constructed, the doors and windows of certain bodegas have been repaired, and considerable repairs have been made to bodegas C, D, and O, in addition to a great number of minor repairs and alterations, all tending to the improvement of the plant.

The business transacted by the arrastre plant for the year, being the handling of all general importations coming into the custom-house, is shown by the following statement:

Fiscal year 1906.	Packages.	Tons.
Merchandise delivered from wharf	653,317	36,747
Merchandise delivered from warehouses	423,285	62,782
Total merchandise landed at custom-house	1,076,602	99,529
Total merchandise given pasé delivery	588,517	30,267
Total merchindise imported per arrastre records	1,665,119	129,796

During the year there were landed on the custom-house wharf 99,529 tons of merchandise, while 30,267 tons were given pasé delivery. The amount of merchandise handled in tons by the arrastre division, by periods of six months, and expense for handling the same, are given in detail below:

Deliveries.	Fiscal year.		
	1904.	1905.	1906.
Wharf	11,511	31,430	36,747
Warehouses	56,610	68,084	62,782
Total	68,121	99,514	99,529

Percentage of merchandise delivered from—	Fiscal year.				
	1904, first and second half.	1905.		1906.	
		First half.	Second half.	First half.	Second half.
Wharf	0.169	0.301	0.327	0.345	0.396
Warehouses	.831	.699	.673	.655	.604

Expense of operation.

1904	₱87,488.93
1905	73,785.68
1906	93,344.47

The work of the plant has been so systematized that by consolidation of personnel it has become possible to perform the duties previously pertaining to the warehouse division of the custom-house with a considerable number of employees less than were formerly found to be necessary.

During the past fiscal year, as heretofore, no trouble has been experienced in securing competent Filipino laborers to perform the arrastre work nor in obtaining good results therefrom. The same system which was in vogue in former years has been continued and the salaries of arrastre laborers remain the same.

The financial statement of the arrastre plant for the year July 1, 1905, to June 30, 1906, is as follows:

DEBITS.

Treasurer's balance, July 1, 1905	₱36, 339. 18
Arrastre disbursing officer's balance, July 1, 1905	6, 253. 48
Cash balance, July 1, 1905	1, 851. 72
Total	44, 444. 38
Gross cash receipts, arrastre collections	112, 693. 69
Cash receipts (miscellaneous)	52. 76
Total debits	157, 190. 83

CREDITS (EXPENDITURES).

Refunds	₱149. 51
Contingent	4, 475. 49
Plant (permanent)	2, 799. 19
Salaries	61, 849. 00
Extra services, customs employees	318. 85
Repairs	8, 385. 01
Reimbursement of losses to importers	30. 90
Wages, laborers	15, 336. 52
Total	93, 344. 47
Treasurer's balance, June 30, 1906	61, 635. 14
Arrastre disbursing officer's balance, June 30, 1906	961. 77
Cash balance, June 30, 1906	1, 249. 45
Total credits	157, 190. 83

NOTE.—Cash receipts (miscellaneous) consist of part of premium on surety bond and collection from a fine and property lost.

None of the machinery, derrick, cranes, or locomotives have been renewed during the past year. With certain repairs that have been made, it is thought that the machinery will last for a while yet, but it is probable that one or two steam cranes will have to be replaced by new and fast-moving ones within the next year, and it will also be necessary to purchase a modern crane for heavy work. The locomotive purchased with the plant is in good condition, considerable repairs having been made on it, and it will not have to be replaced for the present.

Since February 9, 1906, Deputy Surveyor Clifford D. Ham has been detailed as acting collector of customs at Cebu, and the arrastre plant has been satisfactorily managed by Acting Insular Surveyor C. I. McCaskey, in addition to his other duties.

ADMEASUREMENT.

The following is a statement of the vessels in the Philippine Islands admeasured during the past fiscal year:

Port.	Number of vessels.	Amount of fees.	Port.	Number of vessels.	Amount of fees.
Aparri	8	₱23.39	Puerto Princesa	15	48.00
Balabac	2	24.00	Iloilo	5	136.00
Cebu	8	278.00	Zamboanga	3	9.00
Dumaguete	16	180.00			
Manila	245	2,517.55	Total (8 ports)	302	3,215.94

Of the number of vessels admeasured at Manila, 154 were of less than 15 tons gross burden and exempt from the payment of admeasurement fees, under the provisions of act No. 1354 of the Philippine Commission. Of the remaining number of vessels admeasured at Manila, 25 were Government vessels and no fees were charged for the admeasurement thereof.

The greater part of the admeasurement work in the islands has now been completed.

PHILIPPINE MARINE EXAMINATIONS.

Pursuant to the provisions of act No. 780 of the Philippine Commission, the board on Philippine marine examinations has been regularly convened, and the following licenses and certificates of service have been issued by the board during the fiscal year of 1906:

Licenses.

Rank.	Citizens of the—				Total.
	Philippine Islands.		United States.		
	Original.	Renewed.	Original.	Renewed.	
Master	3	50	10	13	76
Chief mate	9	3	4	7	23
Second mate	8	8	1	4	21
Third mate	22	15	1	1	39
Patron	17	145	2	3	167
Chief engineer	10	111	3	4	128
First assistant engineer	21	65	7	1	94
Second assistant engineer	56	72	1	1	130
Bay and river engineer	66	133	1		200
Total					878

Certificates of service.

Rank.	Subjects of—					Total.
	Spain.	Great Britain.	Germany.	China.	Japan.	
Master	32	4				36
Chief mate	9		2			11
Second mate	1					1
Patron	3					3
Chief engineer	20	1			1	22
First assistant engineer	5					5
Second assistant engineer	2			2		4
Bay and river engineer				1		1
Total						83

The above shows a total of 961 licensed marine officers in the Philippine Islands on June 30, 1906, or an increase of 69 over the number on June 30, 1905. Of these, 897 are citizens of the Philippine Islands, an increase of 172 over the number at the close of the preceding fiscal year.

STATISTICS.

The most striking fact which is revealed by a study of the trade statistics of these islands during recent years is the number and amount of imported articles which should be produced here, thus retaining in the Philippines the large sums of money which are expended to pay for such products.

With regard to rice, which was the most prominent example of the abovementioned condition, the situation has greatly changed in the past two years, and, while considerable amounts are still imported, the decrease, due to local production, has been so great as to give cause for much satisfaction from an economic standpoint.

There are numerous other lines, however, in which great improvement could be made, and it may not be improper at this particular time, when the islands are suffering from commercial depression, stagnation of trade, and scarcity of money, to dwell on the fact that no inconsiderable amount of money is yearly lost to the people here through its being spent in foreign countries for articles which can and should be produced in the Philippines. Indeed the production of these articles here would have thrown the balance of trade decidedly in favor of these islands instead of the figures being practically at a parity, as is the case at present.

EXPORTATION OF PINEAPPLES.

It is a well-known fact that the pineapple produced in the Philippine Islands in its wild state (for no cultivation whatever has been given to this fruit) compares very favorably with the world-famous pineapples of the Straits Settlements, for which Singapore has become a permanent shipping point. The comparison does not hold good in size for the very patent reason that no attempt has been made in the Philippines to improve the fruit by cultivation. In many parts of the islands pineapples mature and are wasted, no effort being made to market them. The possibilities in this particular line are evident, and this popular fruit might easily become a source of wealth to the islands with the expenditure of a small amount of capital, coupled with intelligent labor. Nature will attend to replenishing the stock from year to year, and all that the grower would have to do would be to apply improved methods to its cultivation and take steps properly to safeguard and dispose of the fruit at maturity. Pineapples stand shipment very well, inasmuch as they can be transported before entirely ripe. The demand for this fruit in the United States is enormous, and it is understood that the supply at the present time is received largely from the Hawaiian Islands. The possibilities of a source of wealth from this one product would be enhanced many fold by the introduction of canning plants here, as has been done in the Straits Settlements.

CATTLE.

An analysis of the statistical returns for the past fiscal year, which may be accepted as a criterion, reveals at once some of the underlying causes of the prevalent hard times and impoverished condition of the islands. The money spent annually for meat goes to foreign countries, although there lies in the northern part of Luzon an expanse of grazing lands which would support unlimited cattle and produce beef for all local consumption. This is not a mere theory, for it is a fact that in former years cattle were produced in cattle on the hoof was neither necessary nor profitable. During the last fiscal year cattle were imported to the value of $828,206.

RICE.

Everyone is more or less familiar with the enormous importations of rice which have been made into the Philippine Islands since American occupation. Happily each year during the last three has seen the imports of this staple decrease, which naturally indicates an increased local production of this article. The proximity of the Philippine Islands to Japan makes the contrast all the more striking in discussing the production of rice in the respective groups of islands. Japan, with its millions of inhabitants, produces not only rice sufficient to feed them all but has a surplus for export.

LUMBER.

Millions of dollars are spent each year by the Army, the Navy, the insular government, and private individuals for lumber, imported extensively from the United States. While it is well that a market has been found in these islands for United States lumber, yet a large percentage of this commodity should, by all the laws of political economy, be obtained for local consumption in these islands, which, with their virgin forests of timber, admitted on all sides to possess lasting qualities and a durability not found in the timber of other sections of the world, await the woodsman's ax.

EGGS.

It may come as a source of surprise to the average citizen here that last year there were imported into these islands eggs valued at $265,512 gold, notwithstanding the fact that the successful raising of poultry is as easy of accomplishment here as in any other part of the world. The imported eggs come entirely from the Chinese Empire.

VEGETABLES.

Large sums are expended annually by the people of these islands for foreign-grown vegetables, such as potatoes, cabbages, onions, and tomatoes, in their natural state, no reference being intended to the canned articles which the climatic conditions of the islands make it necessary to import. All the vegetables mentioned in the foregoing list have been and can be produced in the Philippine Islands and this fact alone makes it a regrettable commentary on economic conditions that enormous sums are each year spent abroad by an impoverished people for such articles. The investment of outside capital is not required to raise all the indigenous fruits, vegetables, and poultry needed for home consumption. Nature would respond with bounteous returns if aided by a little enterprise and proper endeavor.

The value expressed above for the various articles is only the actual value of the merchandise, and does not include the many incidental costs and expenditures, as freight, insurance, packing, duty (in some cases), profit, etc., all of which must be borne by the consumer of the articles.

COCOANUT OIL.

The past year has seen the completion and successful operation of a cocoanut-oil manufactory established by New York capital in the outlying district of Pandacan, adjacent to Manila. At this place the raw copra is successfully converted into various kinds of cocoanut oil and by-products of the cocoanut. These manufactures find a ready market here and in the neighboring countries, where the demand is constant and on the increase. What has been done with the cocoanut should be attempted in other lines, and thus keep here the large sums which are paid annually for labor, profit, and other items incident to the manufacture of articles which should be produced in the Philippine Islands but are at the present time obtained for its inhabitants only through the medium of importation.

HEMP.

The Philippine Islands, although producing what was admitted to be the finest hemp in the world, of grades for which there is demand from all quarters of the world, yet do not manufacture from this valuable raw product the rope, twine, and other articles daily needed in almost every line of trade. The establishment of rope-making plants, where rope and binding cord could be manufactured, would not involve a very great outlay of capital, and if such an enterprise were started it would aid very materially in keeping at home an important item of the country's wealth and yearly income which goes abroad for those very necessary articles.

SUGAR.

The remarks made above with reference to hemp apply equally well to sugar. Fortunately, however, there is a sugar refinery in operation at Malabon, as stated in the fourth special report of this office, which converts a large quantity of the raw material into refined sugar for local consumption. The marked decline in value of sugar imports into these islands for the last fiscal year over the corresponding period preceding (the figures being $93,368 and $159,741, respectively), attests the success of the enterprise and should mark out a clear path to others with capital to invest in local industries.

Sugar is exported from the Philippines at a value of 2 cents per pound, and in its changed condition this same necessity is imported at double that price, exclusive of duty, freight, commissions, and other incidental expenses. In other words, the inhabitants of the Philippine Islands give almost 3 pounds of one of their chief products for 1 pound of the identical staple in a refined form.

FLOUR.

More flour is being consumed in the Philippine Islands than ever before, as the statistics of this staple clearly show:

	Fiscal year.	
	1905.	1906.
All countries	$727,591	$824,037
United States	613,987	446,074

The United States controlled the great part of the trade up to and including the fiscal year 1905, but for the corresponding period following the percentage of flour received from the United States decreased greatly, although the total value of this import showed a substantial gain.

It is safe to state, in explanation of this change, that the decrease of flour importations from the United States can be attributed mainly to the prevalence of the boycott against American goods and manufactures by the Chinese, who are the principal retail traders in flour in the Philippines. Likewise they are direct importers of this commodity to a certain extent. It is understood that eighteen months ago none but American flour could be found in any of the Chinese stores. At the present time these places of business carry in stock principally Australian brands of flour.

The following is a general statement of the values of certain articles imported during the fiscal year 1906, which it is believed could be produced in the Philippines:

Cattle	$828,206
Fresh beef	389,015
Wood in boards	344,623
Eggs	265,512
Potatoes	146,714
Onions	94,578
Sugar	93,638
Coffee	91,191
All other vegetables	81,976
Beans and pease in bulk	67,949
Other fruits	58,773
Fresh mutton	23,265
Fresh pork	20,286
Wood in logs and other forms	13,691
Poultry	8,658
Hogs	1,226
A total of	2,529,301

which should remain in the Philippine Islands.

The above table does not include importations of those articles made by the Army, Navy, or civil government.

TRADE WITH THE UNITED STATES.

Of the total value of imports for the fiscal year 1906, $4,333,020 came from the United States, as against $5,839,512 for the corresponding period preceding, or a decrease of $1,506,492.

The total value of Philippine products exported to the United States was $11,580,169, as against $15,678,875 for the fiscal year 1905, or a decrease of $4,098,706.

Although there has been a loss in total values of both importations and exportations, the United States has certainly sustained a greater loss relatively than the other principal countries from which imports are received and to which Philippine products go.

The item of flour, previously discussed in this report, explains a considerable proportion of the loss in imports, and it is possible that the prejudice entertained by Chinese importers against American products has affected other lines of trade in American goods.

Cotton is another staple in which the trade with the United States has declined. The importation of cotton goods from the United States falls from $764,088 in 1905 to $278,796 in 1906, representing a decrease of $485,292, or a loss of two-thirds in one year, notwithstanding the fact that an increase of $304,646 is shown in the total imports of cotton goods during the same period.

Total value of cotton goods imported in 1906, $6,641,608.

In commenting on the exports to the United States, it is stated that $11,168,226 represents the value of hemp, a decrease of $1,786,289 for the corresponding period preceding.

An enormous difference was shown in the value of exports of sugar to the United States, as against the volume of that trade for the fiscal year preceding, viz, $260,104 value for 1906, whereas for the fiscal year 1905 sugar to the value of $2,618,487, or $2,358,383 more was exported to that country.

During the fiscal year 1906 the total values of imports and exports were $25,798,852 and $31,918,380, United States currency, respectively.

In the matter of balance of trade in favor of the Philippine Islands, this showing is the best ever made in the history of the islands, the value of Philippine products exported exceeding the value of all articles of import by $6,119,528, United States currency, which is about $4,000,000 better than the record of any previous year. Notwithstanding the heavy decrease in exports of hemp, mainly attributable to the devastating effects of the severe typhoon of last September, which was followed by an unusual drought in the first part of this year, hemp losses are made up by increase in copra and tobacco exports. Currency is excluded from both imports and exports in the above statistics.

SIGNAL LETTERS AND OFFICIAL NUMBERS FOR PHILIPPINE VESSELS.

The system of signal letters and official numbers for vessels of the Philippine Islands, as outlined in the second report of this office, has been continued, and up to June 30, 1906, 3,739 documented vessels have been assigned official numbers, 391 of which have also received signal letters.

Lists of vessels to which assignments of signal letters and official numbers, and of official numbers only, have been made from July 1, 1905, to June 30, 1906. and have been published in customs administrative circulars Nos. 393 and 405, copies of which are hereto attached marked "Appendix A," which lists, taken in connection with those published in previous reports, complete the record of all vessels to which signal letters and official numbers have been assigned.

PASIG RIVER.

The wharf space in the Pasig River, used principally by coastwise vessels, has been considerably lessened during the past year on account of improvements being made to the river wall on both sides of the Pasig below the Bridge of Spain. When this work has been completed and the new wharf space is available for commerce, the coastwise and local shipping of Manila will be greatly facilitated.

MANILA PILOTS' ASSOCIATION.

During the past year the Manila Pilots' Association has rendered its usual efficient and satisfactory services, and since the completion of the additional breakwater the pilots, in addition to bringing vessels into the Pasig River, now board all incoming foreign vessels—except those having regular mooring buoys, such as the *Hongkong* and other frequently arriving liners—and pilot them to safe berths inside the new harbor.

PROPORTION OF FILIPINO EMPLOYEES.

There has been an increase in the proportion of Filipino employees in this custom-house during the past fiscal year from 59 per cent Filipinos to 60.5 per cent Filipinos among the total classified employees, and from 68 per cent Filipinos to 70.3 per cent Filipinos among the total customs employees of all kinds at Manila.

The following table shows the increase in Filipino personnel in the Manila custom-house by fiscal years from the date of American occupation:

Fiscal year ended June 30—	Classified.		Unclassified (Filipinos).	Total.		Grand total.
	American.	Filipino.		American.	Filipino.	
1899[a]	20	48	....	20	48	68
1900[a]	53	92	....	53	92	145
1901	115	187	74	115	261	376
1902	168	206	111	168	317	485
1903	200	222	98	200	320	520
1904	219	218	173	219	391	610
1905	194	272	146	194	418	612
1906	188	288	157	188	445	633

[a] During these years United States troops were employed in customs work, hence small number of regular employees.

Of the total classified customs employees at Manila about 60.5 per cent are Filipinos, of the unclassified 100 per cent are Filipinos, and of the total customs employed at Manila over 70.3 per cent are Filipinos.

During the past year three Filipino employees have been appointed customs inspectors and now have the heavy responsibilities of controlling the discharge of large foreign vessels, of dealing with foreign marine officers, stevedores, etc., duties which require a maximum of intelligence, firmness, and tact, if they are to be properly performed. A number of lower grade Filipinos employees are being trained for these and similar positions, and as fast as vacancies occur they will be filled in this manner.

CONSULAR FUNCTIONS.

By the provisions of section 84 of the act of Congress of July 1, 1902, the customs officers of the Philippine Islands were clothed with certain quasi consular functions with reference to American seamen, the language of the statute being as follows:

"The laws relating to seamen on foreign voyages shall apply to seamen on vessels going from the United States and its possessions aforesaid to said islands, the customs officers there being for this purpose substituted for consular officers in foreign ports."

The responsibility thereby imposed has increased very much during the past fiscal year, and this office has been called upon to decide many questions arising between masters and seamen growing out of complaints of alleged inhuman and brutal treatment on the high seas and for other less serious acts. In order to supply the United States Navy at Cavite with coal, a large fleet, composed principally of American sailing vessels, is engaged in this trade, plying between Atlantic ports and Cavite. Such a voyage ordinarily consumes four or five months, and upon arrival here the members of the crew, who are the ordinary class of sailors found the world over, insist upon receiving their discharges. Shipping laws of the United States forbid such practice, and the ruling has been made that it is not the policy to discharge American seamen at foreign ports. Many of these sailors leave the vessel without permission, and some desert altogether.

The carrying trade of American lumber from the Pacific coast is handled largely in American sailing vessels.

While nominally acting as the American consul for American seamen, this office is without the same authority in the premises as enjoyed by regular American consuls at foreign ports. It apparently can not even compel the return to his vessel of a deserting American seaman, as the attorney-general for the Philippine Islands has held in an opinion dated November 17, 1905, that there is no authority of law in these islands for such action. Local courts do not take jurisdiction of affairs happening on the high seas on board an American vessel, consequently offenses when reported to this office go unpunished, and the only action open is the discharge of the sailor or sailors, with their consequent removal from the vessel. In the case of a capital offense, the culprit could be kept in irons and returned to the United States for trial, but as such a contingency would rarely arise it will be seen that an anomalous situation prevails and that this office is placed in a rather trying position in its endeavor to protect the American seamen and at the same time American commerce, with no adequate machinery at its command to enforce orders which should be given.

There is an urgent need of legislation to remedy the evil pointed out. Provision should be made for the detention by the local police authorities and the return aboard the vessel on which he was regularly shipped in the United States of any sailor certified by a collector of customs here, acting under the provisions of section 84 of the act of Congress of July 1, 1902, to be a deserter. In act No. 1439, passed January 16, 1906, the Commission has provided means for the return of seamen to foreign vessels at ports in the Philippines.

REFUND OF DUTES ON HEMP EXPORTS.

This office repeats its recommendation made in its fourth special report last year that that part of the act of Congress of March 8, 1902, providing for the refund of duties paid on hemp exported to the United States, should be repealed, for the reasons stated in said recommendation.

NATURALIZATION OF ALIENS IN THE PHILIPPINES.

This office also repeats its recommendation that application be made to Congress by the Philippine Commission for the early passage of an act authorizing the supreme court of the Philippine Islands to admit aliens to become citizens of the United States under the provisions of Title XXX of the Revised Statutes et seq., and authorizing the supreme court of the Philippine Islands and the courts of first instance of these islands (having a seal and clerk) to admit aliens to become citizens of the Philippine Islands, having all the rights of such citizens under section 4 of the act of Congress of July 1, 1902. For fuller discussion of this point reference is made to the recommendation under the same head as this, contained in the fourth special report of this office.

MANILA HARBOR WORK.

The "Malecon fill" of the port improvements has been completed during the past year, and work has been commenced on a new "reclamation," known as the "Luneta fill," extending out into the new harbor in front of the present Luneta driveway.

The object of these port works is to give to Manila a modern harbor sufficiently large and deep to accommodate the probable shipping of the port for some years to come, and so constructed as to protect all shipping during all kinds of weather, and to facilitate and cheapen the operations of loading and unloading throughout the year.

The port works, as at present projected, have already accomplished this to a great extent, but it is believed that even upon the completion of the three new wharves on the "Malecon fill" the new harbor will require certain additional work in order to protect all shipping throughout the year.

Furthermore, unless certain additions shall be made to the present plans, it is believed that it will be necessary to do a considerable amount of dredging each year in order to maintain a depth of at least 30 feet at low water in the main basin.

The reasons for this are the following: The existing west breakwater and additional breakwater only partially inclose the new harbor. Apart from the incomplete protection thereby given shipping, which will be discussed hereafter, there are two streams of sediment constantly pouring into the newly dredged 30-foot basin. One, the most important, comes in a current, which sweeps along the beaches of Pasay and Malate from the general direction of Cavite, bringing with it the deposits of silt of various rivers and esteros which empty into the bay along that shore. These outpourings are constant and large, and they enter the new harbor between the east end of the additional breakwater and the Malate beach. The large basin of the new harbor being 30 feet deep, and the corresponding area to the east of it being from 15 to 27 feet deep, thence gradually shoaling in the direction of Pasay, it follows necessarly that even without the shore current above mentioned the deeper basin will in time fill up. The current, however, greatly hastens this process.

The second stream of sediment enters from the Pasig River through the canal between Engineer Island and the river wall along the south bank of the Pasig, and pours into the inner basin on every falling tide. As the tide in the bay and new harbor necessarily falls much faster than that in the Pasig River, due to the water backed up in the river by full tide, it follows that there is a strong current from the river, through the canal, into the new harbor, on every falling tide, carrying with it a considerable portion of the sediment of the Pasig, which settles in the inner basin, and, subsequently, in the 30-foot basin. The actual proof of this lies in the fact that since the inner (18-foot) basin was dredged out, it filled up in places to only 6 feet in depth, and in addition the current from the Pasig River deposited therein various dead animals and other floating refuse. Of course some of this sediment is being carried into the 30-foot basin, and will in time greatly decrease its depth.

There appears to be one comparatively inexpensive remedy for this state of affairs—that is, to continue the additional breakwater from its present southeast end, in a straight line, to the Malate beach, at the western end of the grounds surrounding the houses of the division staff. This will completely close the new harbor, and will effectually prevent the deposit of sediment therein from the rivers and shore current above mentioned. In addition to doing this, it will give a greatly needed protection to the shipping in the harbor, as at present the wide opening between the additional breakwater and the Malate beach gives certain play to winds or typhoons coming from the southwest, to say nothing of the disturbance caused by the existing entrance to the new harbor. This office has been informed that calculations show that any wave entering the new harbor from the southwest could not attain a height inside of more than 2 feet, but it is believed that in bad weather actual observation will show that they do attain much greater height inside, and that they interfere at times with the operations of loading and unloading.

For this reason, in fourth special report to the honorable secretary of finance and justice (last year), this office recommended that the present entrance to the harbor be closed and that a channel be maintained around the southeast end of the additional breakwater. This was before this office had learned of the shore current and of its effect of filling up the new harbor.

With regard to the sediment which enters through the canal from the Pasig River, one practicable method of preventing or greatly diminishing it would seem to be by putting sluice gates or locks in the canal. To do this, without causing great embarrassment to shipping, would necessitate widening the canal throughout, as also recommended by this office in its fourth special report, and constructing a wall in the center, leaving two canals about 60 feet wide, one for craft entering the river and the other for craft leaving.

The maximum cost of these two works has been roughly estimated at ₱1,500,000; hence it requires only a statement of the annual cost of maintaining a dredging plant sufficient to keep the outer basin at a depth of 30 feet to enable it to be decided whether the additions should be made from the standpoint of economy. From the standpoint of safety and convenience for shipping interests, there is no question that these additions should be made.

There are several other matters in this same connection which, however, are not thought to necessitate particular attention at this time. They are:

(1) The prolongation of the west breakwater, so as to effectually protect the present harbor entrance; the widening of a portion thereof, starting from Engineer Island and extending nearly to the harbor entrance, making thereby a wharf 300 feet wide for the discharge of combustibles, doubtfully sanitary, and other dangerous cargoes.

(2) The construction of a submergible wall from the end of the north bank of the Pasig River, extending outward in a curve to the left for the purpose of diminishing the deposit from the river and assisting in keeping down the bar which forms there, thus enabling the 18-foot channel and entrance to be maintained. This is not considered to be absolutely necessary.

(3) The construction of a wharf 300 feet wide, extending out from the west end of the present Malecon "fill" about halfway to the additional breakwater. This wharf would serve the triple purpose of dividing up the new harbor and breaking the sweep of the winds inside the harbor, of greatly facilitating the loading and discharging operations, and of affording the best possible site for a new custom-house.

The above matters do not take into consideration the fact that 30 feet of water is hardly sufficient for the larger modern steamers, many of whose masters are required to have at least 4 feet of water under their keel at low tide. This office has heretofore recommended, informally, that the new harbor should be dredged to 40 feet in some parts, or at least to 36 feet, and it is still believed that such course will be necessary at no distant date.

The above suggestions are not intended by this office as technical recommendations, but, as this bureau is charged with supervising and facilitating the shipping interests in general in these islands, it is deemed proper to submit them for such consideration as they may merit.

W. MORGAN SHUSTER,
Insular Collector of Customs.

HON. HENRY C. IDE,
Governor-General of the Philippine Islands, Manila.

APPENDIX B.

Total customs collections and expenditures at all entry ports, by fiscal years, during American occupation, August 20, 1898, to June 30, 1906.

Year.	Collections.	Expenditures.
1899	$3,106,380.34	$32,624.24
1900	5,542,289.18	103,393.14
1901	8,982,813.85	231,050.89
1902	8,528,938.12	433,589.16
1903	9,540,706.92	488,086.67
1904	8,493,868.26	563,463.79
1905	8,263,444.25	520,278.87
1906	7,553,090.95	439,103.235
Total	60,011,531.87	2,811,589.995

Customs collections at all entry ports during the five fiscal years ended June 30, 1906.

[Expressed in United States currency.]

Port.	1902.	1903.	1904.	1905.	1906.
Manila	$7,250,809.85	$7,862,271.64	$7,131,379.86	$6,814,910.78	$6,160,408.01
Cebu	550,676.42	829,486.09	634,817.03	782,787.59	644,212.45
Iloilo	612,128.95	702,686.24	604,652.27	531,266.01	585,329.82
Jolo	61,074.36	74,266.57	76,076.05	75,300.28	67,214.89
Siasi	10,298.13				
Zamboanga	43,136.30	65,396.92	41,120.20	54,339.93	89,409.48
Aparri	814.11	6,599.46	1,592.41		
Puerto Princesa			1,718.77		
Cape Melville			545.28		
Bongao			1,223.00	1,552.54	1,456.81
Balabac			743.39	3,267.12	3,825.94
Jurata					1,128.89
Sitanki					104.66
Total	8,528,938.12	9,540,706.92	8,493,868.26	8,263,444.25	7,553,090.95

Summary of imports into the Philippine Islands, by ports, for the six fiscal years ended June 30, 1906.

[Values represented in United States currency, gold and silver coin included.]

Port.	1901.	1902.	1903.	1904.	1905.	1906.
Manila	$28,586,988	$36,604,675	$29,097,688	$28,784,236	$26,071,700	$21,868,257
Iloilo	2,336,918	1,931,800	2,582,883	2,447,670	1,817,576	1,683,172
Cebu	1,430,363	2,124,188	2,895,092	2,662,961	2,634,413	1,700,752
Jolo	326,295	249,693	274,801	269,510	274,110	231,772
Zamboanga	80,597	156,064	249,371	152,372	187,878	306,851
Siasi	57,250	38,524				
Bongao				2,430	4,466	4,764
Puerto Princesa				4,315		
Cape Melville				1,509		
Balabac				2,478	9,845	12,347
Jurata						2,591
Sitanki						152
Total	32,818,411	41,104,944	35,099,835	34,327,481	30,999,988	25,810,658

Summary of exports from the Philippine Islands, by ports, for the six fiscal years ended June 30, 1906.

[Values represented in United States currency, gold and silver coin included.]

Port.	1901.	1902.	1903.	1904.	1905.	1906.
Manila	$21,522,444	$20,462,688	$29,570,375	$30,508,303	$27,393,308	$23,902,986
Iloilo	1,512,046	1,517,814	4,108,028	2,833,324	3,796,181	3,676,883
Cebu	3,093,714	3,913,297	5,614,245	3,489,224	5,663,913	4,789,274
Jolo	230,872	128,832	209,223	120,117	138,355	142,533
Zamboanga	25,090	103,320	172,447	77,543	110,573	135,127
Siasi	47,096	31,136				
Bongao				111	4,755	7,452
Puerto Princesa				450		
Cape Melville				1,859		
Balabac				2,254	9,725	12,128
Jurata						4,304
Sitanki						552
Total	26,431,262	27,157,087	39,674,318	37,033,185	37,116,810	32,671,239

Export and import values for period of American occupation, currency excluded.

Fiscal year.	Imports.	Exports.
1899	$13,116,567	$14,640,162
1900	20,601,436	19,821,347
1901	30,276,200	23,222,348
1902	32,029,357	24,544,858
1903	32,978,445	33,150,120
1904	33,221,251	30,226,127
1905	30,879,048	32,355,865
1906	25,798,855	31,918,380

Excess of exports over imports, 1906, $6,119,528.

Total imports, period of American occupation, exclusive of currency	$218,901,156
Total exports, period of American occupation, exclusive of currency	209,879,207
Excess of imports over exports	9,021,949

NOTE.—The foregoing table, showing the value of commodities imported into and exported from the Philippine Islands, by fiscal years, during the period of American occupation, are summaries of monthly reports on Forms 3 and 4, Division of Customs and Insular Affairs; fractions of dollars and Government free entry merchandise not included.

Comparative summary of imports into the Philippine Islands, by countries, during the three fiscal years ended June 30, 1906.

Country.	1904.		1905.		1906.	
	Values.	Duties.	Values.	Duties.	Values.	Duties.
United States	$4,843,207	$849,209	$5,839,512	$1,105,677	$4,333,915	$804,441
East Indies (French)	9,357,047	1,321,047	5,968,614	1,063,772	3,854,244	914,813
England	3,954,054	946,868	4,612,537	1,099,146	4,672,416	1,194,461
Chinese Empire	3,278,295	665,916	2,949,071	571,230	2,650,320	463,556
East Indies (British)	2,577,440	627,405	2,007,514	592,059	1,519,653	573,039
Spain	2,017,203	652,272	1,932,078	557,982	1,792,362	540,967
Germany	1,600,878	424,512	1,498,898	389,778	1,360,959	354,722
British Australasia	1,101,092	55,509	1,365,662	62,435	1,523,668	93,676
All other Asia	1,037,584	150,981	978,745	190,990	319,289	76,549
Japan	803,314	274,313	1,018,983	215,635	657,386	216,869
France	1,180,504	295,133	832,607	227,327	834,120	224,225
Switzerland	479,585	109,245	444,970	96,334	592,954	142,172
Russia	238,772	93,799	302,646	126,220	43,928	16,032
Belgium	275,262	52,464	299,155	58,043	259,521	61,856
Mexico	297,004					
Hongkong	770,393	108,487	244,997	59,803	305,738	74,667
Scotland	170,381	43,538	232,641	65,990	544,493	120,659
Italy	118,316	40,316	152,802	44,923	197,865	60,176
Netherlands	91,264	76,628	103,139	70,114	150,165	75,265
Austria-Hungary	92,557	32,701	94,343	27,734	88,788	24,546
East Indies (Dutch)	18,309	5,741	79,175	22,553	70,592	21,762
Quebec, Ontario	8,310	4,360	20,344	11,624	9,367	4,986
Sweden and Norway	2,045	226	6,900	825	4,767	887
Denmark	4,699	556	5,213	316	8,704	600
British China					354	156
Egypt	3,700	2,417	3,540	1,080	1,955	700
Ireland	3,516	899	3,215	498	7,111	1,615
British Columbia	213	31	1,100	606	464	46
Turkey in Asia			819	629	50	6
Turkey in Europe	2,082	1,133	386	225	293	261
Korea	247	37			351	68
Canary Islands					4	1
Malta			195	88	286	129
East Indies (Portuguese)	194		83	24		
Portugal	7	1	57	34	119	46
Nova Scotia			40	15		
West Indies (British)	6	3				
Cuba			5	1		
French China			2		3,513	8
Aden					115	124
Guam					14	2
Hawaiian Islands					743	198
British Africa					72	25
Duty on reliquidation		756				
Total	34,327,481	6,736,505	30,999,988	6,664,430	25,810,658	6,064,311
Of above free of duty	2,714,183		1,683,623		1,998,981	
Dutiable	31,613,298		29,316,365		23,811,677	

Currency included; Government free entries excluded; fractions of dollars omitted.

Comparative summary of exports from the Philippine Islands during the five fiscal years ended June 30, 1906.

[Values represented in United States currency.]

Country.	1902.	1903.	1904.	1905.	1906.
United States	$7,871,743	$13,863,059	$11,102,860	$15,678,875	$11,580,569
England	8,280,478	8,799,329	10,253,615	8,668,823	7,502,730
Spain	869,875	757,500	1,155,866	1,436,627	1,803,775
Hongkong	5,799,123	7,303,234	7,166,143	6,116,737	4,351,914
Japan	1,346,517	1,759,366	1,204,514	548,607	532,245
France	955,828	3,684,116	2,127,365	1,491,753	2,703,328
East Indies (British)	672,614	994,400	1,518,233	723,490	672,261
British Australasia	436,530	336,251	441,114	442,922	457,444
Chinese Empire	295,322	649,502	1,213,399	1,521,087	1,752,138
British Africa	122,073	12,092	52,458	830	8,760
French China	120,180	93,353	110	275	171
Austria-Hungary	88,787	162,197	253,453	37,282	379,021
Germany	75,626	306,664	107,144	130,118	459,426
British China	55,191	394,258	291	20	....
Belgium	46,829	137,103	55,264	43,720	182,861
East Indies (Dutch)	27,442	25,198	30,458	24,132	31,509
Netherlands	20,212	44,061	209,763	73,032	65,852
Italy	17,830	13,177	32,249	59,316	71,260
Quebec, Ontario	7,679	6,157	8,475	7,102	4,802
Gibraltar	6,812	9,499	8,874	5,831	22,369
Russia	12,128	28,147	....	3,230	....
Scotland	3,721	2,787	3,095	3,465	4,250
Hawaii	3,687	5,910	1,130	3,105	2,665
British Columbia	3,648	2,030	2,618	3,467	4,644
All other Asia	3,265	128,332	7,137	3,133	5,318
Guam	2,481	....	....	387	296
German Oceania	1,934	....	....	....	....
East Indies (French)	1,578	109,317	9,419	11,308	6,335
Korea	1,400	710	368	2,080	3,534
Aukland Islands	1,310	130	545	1,819	4,791
Uruguay	1,246	2,700	5,725	7,040	17,422
Switzerland	1,008	457	218	843	3,214
Russian China	905	578	2,443	....	....
Turkey in Africa, Egypt	889	1,952	2,041	20,092	623
Guatemala	411	....	....	....	139
Canary Islands	321	4,128	2,332	760	....
Argentine Republic	150	599	1,382	5,670	9,447
Aden	140	718	622	740	746
Bermuda	119	....	150	....	....
Malta, etc	48	2,970	1,950	1,695	1,798
Greece	7	....	....	....	....
Nova Scotia	....	4,684	7,304	20,141	1,495
Paraguay	....	480	111	....	....
East Indies (Portuguese)	....	163	....	2,940	267
Spanish Africa	....	900	1,786	....	....
Spanish Oceania	....	30	....	....	....
Portugal	....	24,775	40,481	7,900	7,380
French Africa	....	1,035	73	....	70
Mexico	....	....	180	....	1,661
Denmark	....	....	200	4,975	9,295
German Africa	....	....	134	....	....
Sweden and Norway	....	....	93	....	....
All other Africa, Morocco	....	....	....	444	3,085
Chili	....	....	....	....	120
Peru	....	....	....	....	4
Turkey in Asia	....	....	....	....	85
Portuguese Africa	....	....	....	....	120
Total	27,157,087	39,674,318	37,033,185	37,116,810	32,671,239

NOTE.—The following tables accompanying this report have been omitted. Copy of same is on file in War Department. These tables appear in pamphlet edition of the report of the collector of customs, printed in Manila:

Appendix A.—Alphabetical list of names of seagoing vessels documented in the Philippine Islands to which official numbers and signal letters were assigned, covering the period from July 1, 1905, to June 30, 1906.

Alphabetical list of coastwise vessels documented in the Philippine Islands to which official numbers were assigned during the period from July 1, 1905, to June 30, 1906.

Appendix B.—Gross customs receipts, by sources, four fiscal years ended June 30, 1906.

Customs expenditures at all entry ports during five fiscal years ended June 30, 1906.

Customs expenditures, itemized, for all ports, four fiscal years ended June 30, 1906.

Chief articles of import, by values, six fiscal years ended June 30, 1906.

Chief articles of export, by values.

Statement of opium imported into the Philippine Islands during the fiscal years 1899 to 1906, inclusive.

Government free entries.

Imports, by articles, for the fiscal year ended June 30, 1906.

Exports, by articles, for the fiscal year ended June 30, 1906.

Number of coastwise vessels entered.

Tonnage of coastwise vessels entered.

Number of coastwise vessels cleared.

Tonnage of coastwise vessels cleared.

Number of vessels entered from foreign ports.

Tonnage of foreign vessels entered.

Number of vessels cleared for foreign ports.

Tonnage of foreign vessels cleared.

Comparative summary of vessels doing the carrying trade for the Philippine Islands during the three fiscal years ended June 30, 1906.

EXHIBIT No. 3.

REPORT OF THE COLLECTOR OF INTERNAL REVENUE, EX OFFICIO ASSESSOR AND COLLECTOR FOR THE CITY OF MANILA.

DEPARTMENT OF FINANCE AND JUSTICE,
BUREAU OF INTERNAL REVENUE,
OFFICE OF THE COLLECTOR,
Manila, P. I., August 10, 1906.

SIR: I have the honor to submit the following report on the operations of this bureau during the fiscal year ended June 30, 1906:

Summary of collections in the bureau of internal revenue during the fiscal year ended June 30, 1906.

Internal-revenue law (act No. 1189, Philippine Commission):	
Manufacturers of alcohol and tobacco products	₱4, 328, 144. 37
Licenses, dealers in alcohol and tobacco products	494, 321. 63
Licenses, merchants, manufacturers, and common carriers	1, 365, 392. 50
Licenses, occupations, trades, and professions	308, 184. 49
Mines and mining concessions	15, 264. 72
Banks and bankers	155, 160. 50
Insurance companies	20, 181. 18
Documentary stamp taxes	166, 167. 38
Cedulas	1, 756, 777. 00
Miscellaneous	125. 13
Forest products (eight months only)	193, 638. 01
Total	8, 803, 356. 91
Opium law (act No. 1461, Philippine Commission):	
Permits to habitual smokers (three months only)	24, 225. 00
Tax on crude and prepared opium (three months only)	57, 199. 89
Total	81, 424. 89
City of Manila taxes (various acts, Philippine Commission):	
Land tax	1, 208, 265. 31
Matadero receipts	160, 049. 25
Market receipts	269, 430. 88
Liquor licenses	184, 278. 64
Vehicle licenses	13, 621. 10
Rentals of city property	18, 730. 29
Municipal courts receipts	68, 500.77
Pail system	59, 327. 16
Vault cleaning	38, 691. 85
Building permits	17, 958. 90
Water rents	210, 738. 69
Board of health fees	15, 048. 00
Justices of the peace and sheriff's fees	20, 447. 26
Cemetery fees	13, 425. 09
Percentage tax on receipts, Manila Electric Railway and Light Company	28, 662. 85
Other minor receipts, miscellaneous, and internal-revenue dividend	138, 604. 36
Total	2, 465, 780. 40
San Lazaro estate (Executive order No. 15, March 12, 1906):	
Rentals collected during quarter ended June 30, 1906	16, 044. 50

RÉSUMÉ OF COLLECTIONS.

Internal-revenue taxes	₱8, 803, 356. 91
Opium taxes	81, 424. 89
Municipal taxes, city of Manila	2, 465, 780. 40
San Lazaro estate rentals	16, 044. 50
Grand total	11, 366, 606. 70

COST OF COLLECTION.

The total cost to the government for the collection of these taxes was ₱464,592.91, equal to $4\frac{1}{10}$ centavos for each peso collected. This sum includes ₱52,613.15 paid from the city of Manila appropriation as salary and contingent expenses of the assessor and collector's office from July 1 to December 31, 1905, before the work of said office was taken over by the bureau of internal revenue. The above sum, however, does not include the expenses of collection incurred by the provincial governments. Of the total taxes given above 63 per cent was collected in Manila and 37 per cent in the provinces.

APPORTIONMENT OF INTERNAL-REVENUE TAXES.

Under the apportionment provisions of act No. 1189 the internal-revenue taxes collected, as above, will accrue to the various insular and local treasuries as follows:

To the insular treasury		₱5, 122, 871. 80
To the provincial treasuries:		
One-half cedula taxes	₱878, 388. 50	
Ten per cent other collections	683, 049. 58	
		1, 561, 438. 08
To the municipal treasuries:		
One-half cedula taxes	878, 388. 50	
Fifteen per cent other collections	1, 024, 574. 37	
Certain license taxes	216, 084. 16	
		2, 119, 047. 03
Total		8, 803, 356. 91

PART 1.

INTERNAL-REVENUE TAXES.

[Collected under authority of acts Nos. 1189, 1257, 1338, and 1370, Philippine Commission.]

ACOHOL AND TOBACCO PRODUCTS.

Distilled spirits.—There were collected as taxes on spirits removed for domestic consumption during the six months ended December 31, 1905, ₱640,556; during the six months ended June 30, 1906, ₱663,017.04; a total for the year of ₱1,303,573.04, as against ₱855,706.22 collected during the first year's operation of the law. This represents a gain in the tax collections of ₱447,866.82, equal to an increase in the output from the distilleries of 2,239,334 proof liters of distilled spirits or compounded liquors. There were no spirits of domestic manufacture exported to other countries. At the date of making this report the tendency among the many caua (small primitive stills) owners in the provinces is to abandon their present crude and expensive methods and to combine and establish a few modern distilleries. It is believed that in the course of the next two months the majority of the 450 cauas, heretofore in operation, will have disappeared. As fast as the modern stills are installed gaugers are being detailed to service therein.

Fermented liquors.—There were collected as taxes on beer removed for domestic consumption during the six months ended December 31, 1905, ₱57,768.40; during the six months ended June 30, 1906, ₱63,390; a total for the year of

₱121,158.40, as against ₱132,296.04 collected during the first year's operation of the law. This represents a loss in the tax collections of ₱11,137.64, equal to a decrease in the output from the one brewery in the islands of 278,441 gauge liters of beer. The number of consumers of beer in these islands is not as great to-day as it was a year ago. No beer of domestic manufacture was exported to other countries. German and American beers continue to be imported in small quantities, mostly in kegs; the prices at which these foreign beers are sold prevents serious competition with the domestic product. For the present it is believed that the customs duty on imported beer is ample to protect the local brewery from foreign competition.

Leaf tobacco.—The demand for leaf tobacco suitable for the manufacture of cigars for export continued during the last year to exceed the supply. Little has been done toward improving the quality of the leaf or increasing the area under cultivation. The stocks of seasoned leaf are becoming depleted and the use of green tobacco is being resorted to more and more by even some of the responsible manufacturers. As a result, several brands of cigars formerly in great favor are rapidly becoming discredited. This office has prepared regulations for the guidance of tobacco growers, manufacturers, and internal-revenue officers, and it is believed that within a few months such data will be secured as will greatly assist in the prevention of frauds on the revenues and will also be of considerable statistical value to the government and to the growers and manufacturers themselves.

Manufactured tobacco, smoking and chewing.—There were collected as taxes on manufactured tobacco removed for domestic consumption during the six months ended December 31, 1905, ₱59,895.93; during the six months ended June 30, 1906, ₱60,799.32; a total for the year of ₱120,695.25, as against ₱92,875.19 collected during the first year's operation of the law. This represents a gain in the tax collections of ₱27,820.06, equal to an increase in the output from the various manufactories of 57,958 kilograms of smoking and chewing tobacco. In addition to the manufactured tobacco consumed in these islands, and which paid the tax as above, the exports during the year of smoking tobacco, free of tax, to other countries were as follows:

Country sent to.	From July 1 to December 31, 1905.	From January 1 to June 30, 1906.	Total export for fiscal year 1906.
	Kilos.	*Kilos.*	*Kilos.*
Gibraltar	9,769	18,400	28,169
Africa		18,400	18,400
Canary Islands	1,840		1,840
Italy	1,840		1,840
Spain	1,840		1,840
China	769	728	1,497
India		108	108
Egypt		6	6
Germany		3	3
United States	1		1
Consumed on high seas	2,891	2,785	5,676
Total	18,950	40,430	59,380

During the first year's operation of the law manufactured tobacco was exported as follows:

	Kilos.
To Spain	7,949
To Straits Settlements	2,814
To England	2,320
To China	1,958
To Japan	3
Total	15,044

The amount of manufactured tobacco exported from these islands during the fiscal year ended June 30, 1906, shows an increase, as compared with the amount exported during the first year's operation of the law, of 44,336 kilograms. The increase in the export of manufactured tobacco is due, almost in its entirety, to newly discovered markets in Africa and Gibraltar. The export of manufactured tobacco to the United States is nil.

Cigars.—There were collected as taxes on cigars removed for domestic consumption during the six months ended December 31, 1905, ₱89,347.17; during the six months ended June 30, 1906, ₱92,651.44; a total for the year of ₱181,998.61, as against ₱160,737.34 collected during the first year's operation of the law. This represents a gain in the tax collections of ₱21,261.27, equal to an increase in the output from the various manufactories of 4,531,717 cigars. In addition to the cigars consumed in these islands and which paid the tax, as above, cigars were exported, tax free, during the year to other countries as follows:

Country sent to.	From July 1 to December 31, 1905.	From January 1 to June 30, 1906.	Total exports for the fiscal year 1906.	Total exports during first year's operation of law.
China	18,639,993	22,637,624	41,277,617	49,735,660
Australia	4,993,310	6,207,261	11,200,571	6,059,808
England	5,329,421	4,627,155	9,956,576	5,258,583
Straits Settlements	3,911,149	2,397,509	6,308,658	7,857,821
India	1,915,021	2,376,355	4,291,376	1,779,614
France	1,154,850	2,486,050	3,640,900	1,875,000
Germany	1,672,140	1,907,325	3,579,465	747,007
Spain	1,359,010	1,756,250	3,115,260	3,230,170
South America	475,000	1,078,100	1,553,100	752,137
Denmark	609,000	590,080	1,199,080	....
Italy	122,250	621,800	744,050	273,570
New Zealand	292,500	380,149	672,649	131,716
Gibraltar	482,000	118,150	600,150	....
Canada	180,000	342,600	522,600	116,153
Japan	5,800	333,815	339,615	584,727
Canary Islands	70,000	260,000	330,000	....
Switzerland	318,629	....	318,629	82,175
Indo-China	139,950	116,499	256,449	502,910
United States	83,759	147,447	231,206	167,693
Java	103,250	123,150	226,400	476,167
Holland	55,500	153,000	208,500	55,000
Honolulu	174,000	28,030	202,030	144,500
Africa	90,000	72,632	162,632	455,391
Korea	37,525	83,605	121,130	16,296
Belgium	....	74,675	74,675	25,500
Egypt	30,000	2,500	32,500	43,050
Guam	17,500	4,500	22,000	....
Russia	....	11,280	11,280	....
Scotland	500	5,525	6,025	19,700
Guatemala	6,000	....	6,000	....
Persia	....	....	....	5,000
High seas	1,219,840	1,910,579	3,130,419	862,782
Total	43,487,897	50,853,645	94,341,542	81,258,130

The following comparative figures are submitted:

Year.	Number of cigars manufactured and—		Total.
	Consumed in the Philippine Islands.	Exported to foreign countries.	
First year's operation of law	69,652,820	81,258,130	150,910,950
Fiscal year ended June 30, 1906	74,184,537	94,341,542	168,526,079
Increase during fiscal year ended June 30, 1906	4,531,717	13,083,412	17,615,129

China continues to be the best customer for Philippine cigars. There was a marked increase in the number of cigars exported during the year to Australia, England, India, France, and Germany, and new markets have been opened in Denmark, Gibraltar, the Canary Islands, Guam, Russia, and Guatemala. There was a small increase in the number of cigars exported to the United States and a small decrease in the number exported to Spain. The United States now takes one-fourth of 1 per cent of all of the cigars exported from these islands. If the United States took them all it would add a little over 1 per cent to the total number of cigars now being manufactured and consumed in that country. From the last annual reports made by the United States Commissioner of Internal Revenue to the Secretary of the Treasury it is learned that there is a fairly regular annual increase of over 2 per cent in the number of cigars consumed in the United States. During the fiscal year 1904 there were 7,354,788,520 cigars manufactured in that country, and during the fiscal year 1905 there were manufactured 7,580,255,060 cigars, equal to an increase in one year of 225,466,540 cigars manufactured and consumed. Therefore if the 94,341,542 cigars manufactured in these islands and exported to all countries, including the United States, were exported exclusively to the United States they would supply the natural increase in the cigar consumption there for about five months, after which, the entire present Philippine cigar export trade having been assimilated for all time to come in the American market, the American cigar manufacturer would continue with all of his old trade plus his regular increase of 2 per cent or more from year to year. In other words, if it were possible to divert the entire export cigar trade of these islands to the United States, then at the end of the first year during which all of the Philippine cigars were received and consumed in the United States the American cigar manufacturers would find that instead of having enjoyed their regular 2 per cent increase over their previous year's trade they would, because of the entry of the Philippine cigar, have only enjoyed an increase of about 1 per cent over their previous year's trade; but during each of the years subsequent to the first year in which Philippine cigars invaded their market the American manufacturers would find that their annual increase in trade from year to year would resume the regular previous rate of interest—i. e., about 2 per cent.

In the calculation made above it is assumed (1) that all of the cigars now exported to other countries would be suited to the American market and that the exporters in these islands would be willing to abandon their markets in other countries in order to send all of their cigars to the United States; as a matter of fact about half of the cigars exported from these islands are of very inferior grades, are sent to China, and would not find purchasers if sent to the United States, and furthermore, as regards the cigars of better quality, it can safely be stated that as long as European goods continue to be imported into these islands a certain large proportion of the exports from these islands. including, of course, cigars, will continue to go to Europe. It is assumed (2) that the Philippine cigars entering the United States market will compete only with American-made cigars; as a matter of fact and taste few American smokers like any but home-made cigars, and the Philippine cigar in the United States will find its largest consumers among smokers who had already discarded the American-made cigar because they had acquired a taste for Cuban, Porto Rican, and other imported cigars. It is assumed (3) that the cigar export trade to the United States will not in future exceed the present total export trade to all countries; as a matter of fact no one acquainted with the scarcity of good tobacco lands in these islands to-day, available for cultivation and with satisfactory transportation facilities, need be told that it will be very many seasons before, under the most favorable circumstances and alluring hopes of lucrative trade, tobacco planters could possible increase the yield of their present holdings, or increase their present holdings, so as to supply sufficient leaf for the manufacture of a hundred million more cigars per annum than are being manufactured in these islands to-day. On the contrary it is a well-known fact that the tobacco-leaf supply is at present inadequate to meet the demands of local manufacturers who make cigars for domestic consumption, and that such tobacco leaf as is available is of a quality totally unsuited for the making of cigars for export to the United States and to most European countries. So low, indeed, is the supply of good leaf tobacco that the increase of a few million cigars in last year's export trade was obtained at the cost of a distinct lowering of the quality of the cigars consumed in these islands.

For these reasons it is believed that the American cigar market will not be affected by the advent therein of the Philippine cigar, even to the insignificant extent expressed above; that the Philippine cigar will, if admitted to the American market, soon become a negligible factor in the cigar problem in that country; that, as happened in 1901-2 with the Porto Rican cigars, the relatively small supply of Philippine cigars will soon become merged with the mass of cigars in the vast American market, be assimilated and forgotten.

Cigarettes.—There were collected as taxes on cigarettes removed for domestic consumption during the six months ended December 31, 1905, ₱1,179,871.51; during the six months ended June 30, 1906, ₱1,177,811.63—a total for the year of ₱2,357,683.14, as against ₱1,996,131.57 collected during the first year's operation of the law. This represents a gain in the tax collections of ₱361,551.57, equal to an increase in the output from the various manufactories of 539,629,000 cigarettes. In addition to the cigarettes consumed in these island and which paid the tax, as above, cigarettes were exported, tax free, during the year to other countries as follows:

Country sent to.	From July 1 to December 31, 1905.	From January 1 to June 30, 1906.	Total exports for the fiscal year 1906.	Total exports during first year's operation of law.
China	6,711,937	11,635,240	18,347,177	8,924,655
Straits Settlements	301,086	404,250	705,336	666,990
Indo-China	180,000	60,280	240,280	....
Guam	45,000	120,000	165,000	159,700
India	70,050	93,400	163,450	511,820
Korea	152,250	3,000	155,250	....
United States	120,984	15,000	135,984	191,916
France	100,000	....	100,000	1,040,000
Australia	9,778	87,500	97,278	263,528
Java	....	85,500	85,500	27,785
South America	....	63,750	63,750	....
Germany	36,000	20,062	56,062	....
Spain	14,800	39,600	54,400	1,231,325
England	13,000	12,950	25,950	697,194
Belgium	....	22,500	22,500	....
Japan	6,720	11,108	17,828	113,816
Switzerland	4,200	....	4,200	821,430
Siberia	....	450	450	....
Canada	....	....	....	14,765
High seas	345,380	277,069	622,449	245,341
Total	8,111,185	12,951,659	21,062,844	14,910,265

The following comparative figures are submitted:

Year.	Number of cigarettes manufactured and—		Total.
	Cousumed in the Philippine Islands.	Exported to foreign countries.	
First year's operation of law	2,964,441,590	14,910,265	2,979,351,855
Fiscal year ended June 30, 1906	3,509,038,750	21,062,844	3,530,101,594
Increase during fiscal year ended June 30, 1906	544,597,160	6,152,579	550,749,739

Matches.—There were collected as taxes on domestic and imported matches during the six months ended December 31, 1905, ₱111,769.71, and during the six months ended June 30, 1906, ₱131,266.22; a total collection for the year of ₱243,035.93, as against ₱175,053.39 collected during the first year's operation of the law. This represents a gain of ₱67,982.54 as taxes equal to 169,956 gross of boxes of matches. The manufacture of matches is a comparatively new industry in these islands, there being as yet but one manufactory—established about four years ago in the suburbs of Manila. This manufactory has recently abandoned the use of imported raw material, and is now using native woods. During the first half of the year for which this report is rendered the imported matches, largely Japanese, supplied 57 per cent of the trade and the domestic match 43 per cent. During the last half of the year the domestic match forged ahead, the proportion now being, imported matches 42 per cent, domestic matches 58 per cent.

LICENSE TAXES.

The license taxes imposed in the internal-revenue law did not become operative until January 1, 1905. Statements of collections under these heads for the first year's operation of the law are, therefore, not presented, inasmuch as they would have no value for purposes of comparison with the collection during the complete year for which this report is made.

Dealers in alcohol and tobacco products.—There were collected as specific license taxes during the year ₱494,321.63. Of this amount 50 per cent was paid by dealers in distilled and manufactured liquors, 31 per cent by dealers in tobacco products, 10 per cent by dealers in beer, and 9 per cent by manufacturers and peddlers.

Merchants, manufacturers, and common carriers.—There were collected as percentage taxes during the year ₱1,365,392.50. Of this amount 92 per cent was paid by merchants, 6 per cent by manufacturers, and 2 per cent by common carriers. By the provisions of law owners of ships paying a tonnage tax are exempt from the internal-revenue tax; this accounts for the relatively small amount collected as taxes from common carriers. Section 139 of the internal-revenue law imposes a tax at the rate of one-third of 1 per cent on the value of commodities sold in these islands by merchants and manufacturers; alcohol and tobacco products sold by the manufacturers thereof or by merchants are exempt from this tax, as are also all sales of all kinds of agricultural products made by farmers and of all kinds of commodities made by merchants whose annual sales do not exceed in value ₱500. A certain large portion of the goods sold in these islands therefore escapes this tax. The rate of the tax means ₱1 tax payment on each ₱300 worth of goods sold. There were collected as taxes during the year from merchants ₱1,257,282.80, from manufacturers ₱76,710.42, total ₱1,333,993.22. This amount of taxes, capitalized at the rate given above, indicates a total value of declared sales of commodities during the year of ₱400,197,966. If to this amount is added the value of all goods and agricultural products not declared for taxation because exempt, it is believed that the total value of all sales actually made in these islands during the year would not fall far short of one-half a billion of pesos.

Occupations, trades, and professions.—There were collected as specific license taxes during the year ₱308,184.49. Of this amount 64 per cent was paid by proprietors of cockpits; 16 per cent by lawyers, doctors, civil engineers, and surveyors; 4 per cent by owners of race tracks, and 16 per cent by all other occupation-license taxpayers. By the provisions of the internal-revenue law the license-tax collections from owners of cockpits accrue intact to the treasuries of the various municipalities in which such taxes are collected. As a result of an active crusade now in progress throughout the islands against the form of sport enumerated above, a large number of owners of cockpits are surrendering their licenses and closing these places of amusement. The crusade was not undertaken soon enough to seriously affect the municipal revenues from this source during the fiscal year for which this report is made, but it is anticipated that during the current fiscal year, and perhaps for some time to come, the efforts of the moral reformers will result in a material diminution of municipal revenues from cockfighting.

Cedulas personales.—There were collected from the sale of cedulas personales, or certificates of registration, during the year ₱1,756,777. This is in the nature of a poll tax, and every male person in the islands, between 18 and 60 years of age, is subject to its payment at the rate of ₱1 if paid during the first four months of the calendar year, and at the rate of ₱2 thereafter. Over 80 per cent of the cedulas sold during the year were of the ₱1 class. Consular representatives of other countries and certain other persons are specifically exempted by law from the payment of this tax, as are also most of the members of the non-Christian tribes. It is believed that the proportion between males within the taxable age and the total population of these islands is as 1 to 5, and as the total number of cedulas of all classes sold during the year is equal to just about one-fifth of the total Christian population of the islands, it can safely be assumed that the cedula tax for the year has been collected practically in its entirety.

Documentary stamp taxes.—There were collected from the sale of documentary stamps during the year ₱166,167.38.

Mines and mining concessions.—There were collected as license taxes and percentage taxes on the output of old Spanish mining concessions during the year ₱15,264.72. All valid perfected mining concessions granted prior to April 11, 1890, are made subject to internal-revenue taxes on and after January 1, 1905. But few of the concessionaires have paid these taxes, and therefore, complying with the provisions of section 137 of the internal-revenue law, this office has taken and is taking the necessary steps to have all such concessions on which the taxes have not been paid declared forfeited to the insular government. The owner of one of the largest concessions paid the taxes on his mines under protest and brought suit against the collector of internal revenue for recovery of the amounts paid on the ground that they were illegally collected, alleging that under the treaty of Paris the Philippine Commission exceeded its powers in imposing a tax on these old concessions. The lower court sustained the collector, and the owner of the mines has taken appeal to the higher courts.

Banks and bankers and insurance companies.—The taxes on these concerns were made effective on and after August 1, 1904. During the first year's operation of the law there were collected as taxes on deposits, capital employed, and circulation of banks ₱106,353.87, and during the fiscal year ended June 30, 1906, ₱155,160.50, a gain of ₱48,806.63. During the same periods there were collected as taxes on the premiums received by insurance companies ₱7,653.13 and ₱20,181.18, respectively, a gain of ₱12,528.05 during the year for which this report is rendered.

Forest products.—During the first three or four months of the year for which this report is rendered the supervision of the payment and the assessment of the internal-revenue taxes on timber and other forest products removed from the public forests and forests reserves in these islands remained under the officials of the bureau of forestry. By the provisions of act No. 1407 of the Philippine Commission the tax rates previously obtaining on forest products were materially reduced and the list of exemptions from the payment of the tax was materially increased. The total tax yield from this source would inevitably be reduced. Complete reports of collections during the fiscal year ended June 30, 1906, are not as yet available for the reason that these collections continued to be made in cash, i. e., not by the use of stamps, and therefore such reports have been delayed in reaching this office. Complete reports from all of the provinces during the first eight months of the year show a collection during that period of ₱193,638.01. Prior to July 1, 1906, the regular invoice forms and other forms have been supplied to all provincial treasurers and to their deputies, and the reports of forestry tax collections for the current fiscal year will in future be complete and available for compilation at an earlier date than has been possible under the old system of collections without the use of stamps.

Comparative figures.—In the preceding captions of this report reference is made for comparative purposes to two periods, (1) the first year's operation of the internal-revenue law, and (2) the fiscal year for which this report is made, i. e., July 1, 1905, to June 30, 1906. The internal-revenue law did not in any of its parts become operative until August 1, 1904. Therefore, when reference is made herein to the first year's operation of the law that period is meant which is included between August 1, 1904, and July 31, 1905. The collections made during the month of July, 1905, are therefore included in both years' collections used for comparative purposes in this report. The results are not therefore absolutely accurate, but they do convey a more truthful comparison between the collections for the two periods than would have resulted had the collections made during an eleven months' period been compared with those made during a twelve months' period. Some comparison was necessary in order to show the various tax movements and the best that the circumstances would permit has been done. The total collections under act No. 1189 are as follows:

August 1, 1904, to June 30, 1905	₱5, 200, 383. 95
During July, 1905	794, 620. 75
Total during first year's operation of the law	5, 995, 004. 70
July 1, 1905, to June 30, 1906	8, 803, 356. 91
Increase during second year's operation of the law	2, 808, 352. 21

The total collections during the first year and eleven months' operation of the law were ₱14,003,740.86. Reports of collections during the month of July, 1906, amounting to ₱786,268.07, are now available. The total collection of internal-revenue taxes during two full years' operation of the law, therefore, have been ₱14,790,008.93. It should be remembered that the internal-revenue law was only partially in operation between August 1 and December 31, 1904.

Stamp and cedula accounts.—Since this bureau was organized until June 30, 1906, internal-revenue stamps, documentary stamps, cedulas, and opium-users' permits have been delivered by the director of printing to the insular treasurer, withdrawn by the collector of internal revenue, and issued to the assessor and collector of Manila and to the various provincial treasurers of the following values:

	Internal-revenue stamps.	Documentary stamps.	Cedulas.	Opium users' permits.	Total.
Printed and delivered to insular treasurer	₱18,037,000.00	₱980,000.00	₱4,000,500.00	....	₱23,017,500.00
To collector of internal revenue	13,490,222.24	653,000.00	4,000,500.00	₱200,000.00	18,343,722.24
Issued by collector of internal revenue	12,425,853.44	472,095.64	3,834,540.00	97,100.00	16,829,589.08
Balance on hand	1,064,368.80	180,904.36	165,960.00	102,900.00	1,514,133.16

Some three months since examiners from the office of the insular auditor completed a thorough audit of the various accounts of this bureau since its organization, including an accurate count of all stamps and cedulas and of all collections of insular and city taxes made by the assessor and collector of Manila. Not one centavo's difference was discovered in the stamp accounts nor in any of the collection accounts. Out of a total of over ₱4,000,000 worth of cedula blanks received in this office from the director of printing the auditor's examiners discovered a shortage of 100 cedula blanks, worth, when filled in by a collecting officer, ₱100. Cedula blanks are serially numbered, and, for convenience sake, are bound in books of 100 each. It has not been discovered that any of the missing cedulas have been issued by collectors of taxes. Evidently one of the books has been mislaid and will be found sooner or later. Meanwhile the clerk charged with the receipt and issue of stamps and cedulas has made a deposit of ₱100 to cover this shortage should the missing book not be discovered.

PART 2.

CITY OF MANILA TAXES.

[Collected under authority of act No. 183, Philippine Commission, and various ordinances and resolutions of the municipal board of Manila.]

Real estate tax.—In the last report of the city assessor and collector, covering the fiscal year ended June 30, 1905, it was stated that the assessment rolls were in better shape than at any previous time. During the fiscal year ended June 30, 1906, surveys of the various blocks were continued, and the further perfection of the assessment rolls has made satisfactory progress. It will take further time to complete this work as originally outlined.

In accordance with the provisions of the Manila charter a new general assessment of all the real property in the city of Manila was made for year 1906. The work of making this assessment has been conducted for the past two years by the city assessor and collector and his force of employees, and important data relative to rentals, sales of property, etc., in all parts of the city have been collated and compiled.

The officers and employees charged with making this assessment have had several years experience, and have had for reference two former assessments, one made by the city assessor and collector in 1901–2, and the other by the board of tax revision in 1903. All new streets, blocks, and lots laid off, as well as new buildings erected or improvements made to existing properties, are at once platted by employees of the division of real estate assessments in this office. The maps already compiled are even now found to be of great assistance to property owners and are a constant source of valuable and reliable information to would-be purchasers of city property. As the time passes and further data, now being gathered by the assessors, are recorded, the value of these maps will increase. All of these data are open to inspection by the public.

Slight errors and irregularities have been discovered in the two former assessments. It is believed that the board of tax revision has eliminated most of the errors found in the preceding assessments. The best evidence that city property is now assessed at approximately its true value and that the assessment is, all things considered, an equitable one, is found in the fact that of the 15,780 different pieces of property assessed, and now appearing on the tax rolls, aggregating in value ₱80,525,235, appeals to the board of tax revision from the valuations fixed by the city assessor and collector, were taken only in the case of 298 parcels, aggregating in value ₱6,868,077. The board of tax revision took action favorable to the applicants in only 34 cases out of the 298 appealed.

The original assessed value of all city property for 1905 was ₱77,754,354. To this there were added further properties worth ₱176,449, discovered after the completion of the original rolls, making a final total assessment for 1905 of ₱77,930,803. For the purpose of making a comparison between the figures for that year and for the year 1906, the 1905 totals must be reduced by (1) the value of all buildings destroyed during 1905, ₱319,694, (2) cancellations made on account of erroneous and double assessments, ₱152,474, and (3) all additional exemptions granted during 1905, ₱502,752, making a total reduction of ₱974,920, and leaving for comparative purposes, ₱76,955,883 as the assessment of 1905.

The 1906 assessment amounts to ₱80,525,235, from which for comparative purposes there must be deducted the value of new buildings erected since the 1905 assessment was completed, equal to ₱2,682,606. This leaves the 1906 valuation at ₱77,842,629, or an increase over the 1905 assessment of ₱886,746. This increase is equal to but a fraction over 1 per cent and is not the result of a general raising of values throughout the city, inasmuch as some valuations have been reduced and others have been increased. Equitable valuation and not forced increases has been the watchword.

The following statement shows the comparative valuation of real estate by districts as of record in the assessment rolls at the beginning of each year:

District.	1903.	1904.	1905.	1906.
Intramuros	₱7,229,404	₱5,022,728	₱5,053,954	₱4,896,697
Binondo	18,826,550	18,576,184	18,779,422	18,671,529
San Nicolas	12,662,338	13,027,050	13,249,290	13,272,457
Santa Cruz	7,410,904	7,701,846	7,992,546	8,578,001
Quiapo	4,254,200	4,411,414	4,600,292	4,822,367
San Miguel	4,687,890	4,962,362	5,006,108	4,976,038
Sampaloc	3,165,798	3,596,696	3,827,772	4,061,036
San Lazaro estate	329,940	458,170	538,066	579,404
Tondo	3,558,448	3,965,116	4,156,914	4,673,891
Ermita	5,689,520	6,271,494	6,708,748	7,155,925
Malate	2,602,038	2,752,768	3,037,502	3,569,165
Paco	2,647,850	2,898,160	3,546,338	3,982,540
Pandacan	342,806	358,796	431,016	440,531
Santa Ana	799,468	812,752	826,386	845,654
Total	74,207,154	74,815,536	77,754,354	80,525,235

The following shows the comparative value, by districts, of new buildings erected during each year:

District.	1903.	1904.	1905.	Total.
Intramuros	₱106,990	₱87,146	₱29,200	₱223,336
Binondo	384,390	250,676	190,272	825,338
San Nicolas	379,768	353,912	248,900	982,580
Santa Cruz	312,330	302,520	207,268	822,118
Quiapo	190,442	196,516	249,738	636,696
San Miguel	286,944	141,356	56,290	484,590
Sampaloc	446,422	273,670	306,650	1,026,742
San Lazaro estate	128,230	79,158	110,764	318,152
Tondo	392,622	209,656	223,398	825,676
Ermita	682,394	522,338	587,526	1,792,258
Malate	191,610	332,924	194,642	719,176
Paco	250,642	653,026	235,744	1,139,412
Pandacan	16,532	74,788	9,970	101,290
Santa Ana	15,004	12,160	32,244	59,408
Total	3,784,320	3,489,846	2,682,606	9,956,772

The collection of delinquent taxes has been attended with some difficulty during the last fiscal year. On December 9, 1905, a sale of certain properties for the purpose of satisfying the delinquent taxes due thereon was held. Fifty-two parcels, owing taxes for the years 1901 to 1904, inclusive (no property was offered for sale on account 1905 delinquency), were advertised for sale. Of these, only ten parcels were actually sold, proceedings against the remainder having been discontinued by reason of the payment of the taxes prior to the date set for the sale.

The tax levy for the second half of 1905 was reduced by the provisions of act No. 1420, Philippine Commission, enacted December 8, 1905, to one-half of 1 per cent. This accounts for the reduction of about ₱300,000 in this year's collections as compared with the estimate made by the city assessor and collector in his last report. Had the tax rate remained at 2 per cent the collections would have exceeded the estimate.

Every effort has been made to reduce the delinquent list and, in addition to the sale mentioned above, over 5,000 notices have been delivered to delinquent taxpayers by agents and employees of this office. The success of these endeavors is shown in the following statement of collections of back taxes during the last fiscal year:

On account of 1901 tax:	
Amount of tax proper	₱140.78
Amount of penalties and interest	51.60
Total collection	192.38
Amount of tax still delinquent	410.02
On account of 1902 tax:	
Amount of tax proper	7,984.46
Amount of penalties and interest	2,654.20
Total collection	10,638.66
Amount still delinquent	2,367.64
On account of 1903 tax:	
Amount of tax proper	6,881.62
Amount of penalties and interest	1,757.84
Total	8,639.46
Less refunds (act No. 975)	727.54
Total net collections	7,911.92
Amount still delinquent	5,646.60
On account of 1904 tax:	
Amount of tax proper	26,515.16
Amount of penalties and interest	6,730.29
Total	33,245.45
Less refunds (act No. 975)	246.76
Total net collection	32,998.69
Amount still delinquent	20,034.29
On account of 1905 tax:	
Amount of tax proper	454,775.98
Amount of penalties and interest	17,340.59
Total	472,116.57
Less refunds (act No. 975)	1,712.20
Total net collection	470,404.37
Amount still delinquent	64,356.35

The tax rolls for the year 1906 were completed on April 19, 1906, which was somewhat later than during previous years. This delay was due to the work incident to making the new assessment and the posting of the tax rolls. The tax for the second half of the year 1906 was reduced by the provisions of act No. 1501, Philippine Commission, enacted June 26, 1906, to one-half of 1 per cent. Anticipating this reduction, the payment of the full year's tax prior to June 26, 1906, was discouraged by this office, as it was foreseen that on all 2 per cent payments, if, as was anticipated, the rate should be reduced, refunds would have to be made. With the exception of about ₱600 paid, for the second half of the year, all of the 1906 tax reported herein as collected represents payments for the first half of 1906 at the rate of 1 per cent of the assessed valuations.

The following is the record of 1906 collections:

Assessed value of all real estate	₱80, 525, 235. 00
Tax levied at 1½ per cent	1, 207, 878. 53
Back taxes taken up for the years 1901 to 1905 (section 50 of act No. 183)	11, 417. 89
Total	1, 219, 296. 42
Less reductions made on account of erroneous and double assessments discovered	12, 221. 25
Leaving total for collection during 1906	1, 207, 075. 17
Amount of taxes proper collected	706, 323. 41
Penalties and interest on back taxes due for years 1901 to 1905	215. 31
Total	706, 538. 72
Less reductions granted under provisions of act No. 975 (₱1,077.19) and act No. 1421 (₱19,342.24)	20, 419. 43
Net actual collections	686, 119. 29

During the entire fiscal year ended June 30, 1906, taxes, penalties, and interest have been collected in the sum of ₱1,208,265.31, being current and back taxes distributed as follows:

1901	₱192. 38	1905	₱470, 404. 37
1902	10, 638. 66	1906	686, 119. 29
1903	7, 911. 92		
1904	32, 998. 69	Total	1, 208, 265. 31

Industrial tax.—The ₱1,191.81 collected as industrial tax during the fiscal year represents 5 per cent levied on the earnings of certain insurance companies and is payment of delinquent 1904 taxes. The industrial-tax law was repealed by act No. 1189, Philippin Commission, effective January 1, 1905. During the fiscal year 1905 there were collected ₱304,021.61 from industrial-tax sources. The city of Manila, therefore, received during the fiscal year ended June 30, 1905, ₱302,829.80 more revenue from the industrial taxes than it did during the fiscal year ended June 30, 1906.

Cedulas or certificates of registration.—Since January 1, 1905, cedula collections have been reported as internal-revenue collections, and the money so collected is returned in quarterly payments by the auditor, together with the internal-revenue dividend of 25 per cent in proportion to population, together with receipts from certain occupation license taxes collected wholly for the benefit of the municipality. A very small portion of the cedula collections for 1906 have so far been returned. All receipts for cedulas sold under the internal-revenue law are shown under the head of internal-revenue dividends. There has been actually collected from the sale of cedulas during the fiscal year 1906 the sum of ₱71,057 (of which ₱846 was for 1904 cedulas sold under the provisions of the old law), as compared with ₱89,881 collected during the fiscal year 1905, resulting in a loss, as compared with 1905, of ₱18,824. A list of all persons delinquent in the payment of this tax is now being prepared in this office, and when completed will be delivered to the chief of police for action.

Matadero.—Collections at the matadero have fallen short of the estimate made by the city assessor and collector in his last report by about ₱15,000, and is due to the scarcity of cattle available for slaughter. The islands furnish very few cattle for this purpose and until just recently Hongkong was the only market from which importations of cattle were received. Several importations have recently been received from Saigon, and it is believed that with this competition the price of cattle will be reduced and that the collections will be somewhat larger during the fiscal year ending June 30, 1907, than they were during 1906. The expense of operating the matadero has been reduced by about ₱2,000 as compared with 1905. The following statement shows, by months, the number of animals slaughtered, the weights in kilograms, and the fees collected:

Month.	Cattle.			Hogs.		
	Number.	Weight.	Collection.	Number.	Weight.	Collection.
1905.		*Kilos.*			*Kilos.*	
July	1,757	234,103	₱7,023.09	4,146	214,726	₱6,441.78
August	707	225,971	6,779.13	4,059	204,455	6,133.65
September	860	241,063	7,231.89	3,921	200,547	6,016.41
October	1,862	258,824	7,764.72	3,763	199,193	5,975.79
November	1,809	242,007	7,260.21	3,514	179,789	5,393.67
December	1,901	255,498	7,664.94	3,751	195,341	5,860.23
1906.						
January	1,733	226,971	6,809.13	3,902	193,877	5,816.31
February	1,388	185,788	5,573.64	3,517	188,053	5,641.59
March	1,575	200,204	6,006.12	4,120	229,677	6,890.31
April	1,579	200,359	6,010.77	3,860	219,350	6,580.50
May	1,736	197,006	5,910.18	4,169	228,517	6,855.51
June	1,401	194,572	5,837.16	3 952	219,444	6,583.32
Total	18,308	2,662,366	79,870.98	46,674	2,472,969	74,189.07

Month.	Suckling pigs.			Sheep.		
	Number.	Weight.	Collection.	Number.	Weight.	Collection.
1905.						
July	585	17,034	₱511.02	5	67	₱2.01
August	604	17,641	529.23	...	...	...
September	598	16,746	502.38	...	...	...
October	686	19,377	581.31	...	...	...
November	569	16,649	499.47	...	...	...
December	582	17,068	512.04	...	...	...
1906.						
January	639	21,316	639.48	...	...	...
February	450	13,262	397.86	...	...	...
March	488	13,661	409.83	...	...	...
April	539	15,156	454.68	1	20	.60
May	542	15,898	476.94	2	14	.42
June	516	15,669	470.07	4	62	1.86
Total	6,798	199,477	5,984.31	12	163	4.89

Making a total of 5,334,975 kilograms of dressed meat removed from the matedero during the year, and a total collection of ₱160,049.25. The expenses incident to the operation of the matedero have been as follows:

Salaries and wages	₱8,594.16
Blank forms	188.05
Supplies, such as wood, oil, etc	817.67
Total	9,599.88

which represents less than 6 per cent of the total collections.

Public markets.—There has been no change either in the number or location of the public markets since the date of the last annual report of the city assessor and collector. Of the 9 public markets, losses in the collections for the fiscal year 1906, as compared with the collections for the fiscal year 1905, are shown in the case of 7, as follows:

Divisoria	₱10,230.80	Herran	₱54.82
Quinta	10,808.96	Anda	1,192.11
Arranque	6,461.07	Santa Ana	202.92
Sampaloc	481.55		

Increases, as follows, are shown in the collections made in two of the markets:

Gagalangin	₱234.23
Pandacan	453.62

The increases in the collections from the Gagalangin and Pandacan markets are due to the fact that a full year's collection was not made in either of these markets during the fiscal year 1905, the former having been opened on November 21, 1904, and the latter on January 9, 1905. The loss of ₱6,740.82 in the collections made at the Bay and Estero landings is due to the fact that these collections were discontinued on January 8, 1906, in accordance with a resolution of the municipal board. The suspension of these collections is largely responsible for the comparatively small collections made in the 9 regular markets. No action has as yet been taken to prohibit sales at the Bay and Estero landings, and it is believed this practice has, to the detriment of the regular markets, increased considerably since the collection of market fees at such places was discontinued. However, it is not believed that the entire loss can be attributed to this, as small losses are shown in the collections for the first six months of the fiscal year 1906, as compared with the first six months of the fiscal year 1905, and the suspension of collections at the Estero and Bay landings did not affect that period. The total market fees collected for the fiscal year 1906 amount to ₱269,430.88, as compared with ₱304,916.34 collected during the fiscal year 1905, resulting in a loss of ₱35,485.46. The expenses incident to the collection of all market fees for the year were ₱20,513.90, or 7.61 per cent of the total collections. The cost of collections by markets range from 6.1 per cent in Sampaloc to over 45 per cent in the Gagalangin market. The following statement shows the collections by months at each market during the fiscal year 1906:

Name of market.	July.	August.	September.	October.	November.	December.	Total half year ending Dec. 31, 1905.
Divisoria	₱13,366.80	₱12,567.40	₱11,666.20	₱13,508.30	₱12,174.50	₱12,230.60	₱75,513.80
Quinta	6,473.59	5,699.63	5,240.05	6,116.02	5,050.10	5,058.46	33,637.85
Arranque	2,381.89	2,160.20	1,971.49	2,261.52	2,019.16	2,003.34	12,797.60
Sampaloc	652.45	637.80	551.86	629.39	677.79	769.26	3,918.55
Herran	1,087.76	941.37	879.34	1,029.97	1,286.51	942.40	6,167.35
Anda	196.75	188.25	234.60	210.10	219.75	245.83	1,295.28
Santa Ana	152.66	150.58	127.89	135.58	140.02	130.88	837.61
Gagalañgin	60.30	64.25	57.57	69.42	75.44	78.18	405.16
Pandacan	117.88	118.42	89.29	103.07	109.86	100.63	639.15
Tetuan	312.07	384.27	849.11	364.77	214.48	233.77	2,358.47
Bay	382.32	409.47	282.12	554.64	483.15	425.30	2,537.00
Estero	792.85	712.25	508.19	523.79	497.55	601.25	3,635.88
Total	25,977.32	24,033.89	22,457.71	25,506.57	22,918.31	22,819.90	143,743.70

Name of market.	January.	February.	March.	April.	May.	June.	Total half year ending June 30, 1906.
Divisoria	₱13,242.20	₱11,094.70	₱11,891.10	₱12,887.60	₱11,740.50	₱11,383.80	₱72,239.90
Quinta	5,679.61	4,525.95	4,684.65	5,097.90	4,551.45	4,328.65	28,868.21
Arranque	2,246.20	1,888.15	1,957.10	2,177.10	1,924.75	1,884.15	12,077.45
Sampaloc	641.05	578.95	617.90	604.20	603.75	582.05	3,627.90
Herran	1,076.72	940.10	994.05	1,047.40	940.60	907.70	5,906.57
Anda	187.20	163.10	162.20	147.75	128.75	134.10	923.10
Santa Ana	134.77	121.60	136.75	123.15	132.20	127.20	775.67
Gagalañgin	74.40	65.15	77.00	71.25	73.80	84.20	445.80
Pandacan	96.69	86.85	89.85	83.05	99.30	94.60	550.34
Tetuan	47.54	....	....	....	....	....	47.54
Bay	92.59	....	....	....	....	....	92.59
Estero	132.11	....	....	....	....	....	132.11
Total	23,651.08	19,464.55	20,610.60	22,239.40	20,195.10	19,526.45	125,687.18

Name of market.	Total six months ending Dec. 31, 1905.	Total six months ending June 30, 1906.	Total fiscal year ending June 30, 1906.
Divisoria	₱75,513.80	₱72,239.90	₱147,753.70
Quinta	33,637.85	28,868.21	62,506.06
Arranque	12,797.60	12,077.45	24,875.05
Sampaloc	3,918.55	3,627.90	7,546.45
Herran	6,167.35	5,906.57	12,073.92
Anda	1,295.28	923.10	2,218.38
Santa Ana	837.61	775.67	1,613.28
Gagalañgin	405.16	445.80	850.96
Pandacan	639.15	550.34	1,189.49
Tetuan	2,358.47	47.54	2,406.01
Bay	2,537.00	92.59	2,629.59
Estero	3,635.88	132.11	3,767.99
Total	143,743.70	125,687.18	269,430.88

Municipal licenses.—Under the provisions of existing ordinances, only the following occupations, trades, professions, and objects are subject to the payment of the municipal licenses:

Dealers in spirituous, vinous, and fermented liquors, peddlers (excepting those who sell only native vegetables, fruits, or foods personally carried by themselves), auctioneers, plumbers, hotels, restaurants, lodging houses, livery stables, race tracks, public vehicles, and dogs.

Practically all occupations, trades and professions were subject to the payment of municipal license taxes during the first half of the fiscal year ended June 30, 1905. On January 1, 1905, the Municipal Board's powers to impose license taxes were greatly curtailed by the provisions of act No. 1189, Philippine Commission. This largely accounts for the falling off of over ₱70,000 in the collections from this source during the fiscal year ended June 30, 1906, as compared with the fiscal year ended June 30, 1905.

Liquor licenses.—Collections from the sale of liquor licenses during the fiscal year 1906 were ₱184,278.64, as compared with ₱201,324.86 during the fiscal year 1905, which shows a loss of ₱17,046.22. Liquor licenses were issued and transferred during the fiscal years 1905 and 1906 as follows:

Class.	Fiscal year ended June 30, 1905.			Fiscal year ended June 30, 1906.			Increase.	Decrease.
	Issued.	Transferred.	Total.	Issued.	Transferred.	Total.		
First-class bar	93	16	109	92	28	120	11	
Second-class bar	99	18	117	93	23	116		1
First-class restaurant liquor	41	3	44	38	6	44		
Second-class restaurant liquor	22	4	26	28	5	33	7	
First-class hotel liquor	8		8	3		3		5
Theatres	5	2	7	5	5	10	3	
First-class wholesale liquor	42	4	46	29	1	30		16
Second-class wholesale liquor	7	2	9	3	1	4		5
Third-class wholesale liquor	6	1	7	4	4	8	1	
Grocery liquor	80	8	88	72	8	80		8
Distillers'	8	1	9	6		6		3
Druggists'	4		4	3		3		1
Brewers'	1		1	1		1		
Native wine	2,638	206	2,844	2,741	225	2,966	122	
Total	3,054	265	3,319	3,118	306	3,424	144	39

The following statement shows the number of each class of liquor license in force in the several municipal districts on June 30, 1906, and comparison of totals with those in force on June 30, 1905:

Class.	District.													Total in force June 30, 1906.	Total in force June 30, 1905.
	Tondo.	San Nicolas.	Binondo.	Santa Cruz.	Quiapo.	Sampaloc.	San Miguel.	Walled City.	Paco.	Ermita.	Malate.	Santa Ana.	Pandacan.		
First-class bar	....	7	7	13	5	5	....	7	2	....	....	....	....	46	55
Second-class bar	....	2	....	2	1	38	....	....	....	....	....	....	....	43	58
First-class restaurant liquor	....	1	3	9	2	1	....	2	....	....	....	....	....	18	23
Second-class restaurant liquor	....	2	4	3	....	....	....	1	1	....	1	....	....	12	9
First-class hotel liquor	....	....	1	1	....	....	....	....	....	....	....	....	....	2	6
Theaters	....	....	1	2	....	....	....	....	....	....	....	....	....	3	3
First-class wholesale liquor	....	6	18	1	....	....	....	3	1	....	....	....	....	29	39
Second-class wholesale liquor	....	....	3	....	....	....	....	....	....	....	....	....	....	3	7
Third-class wholesale liquor	....	....	1	1	....	....	....	1	....	....	....	....	....	3	6
Grocery liquor	....	18	30	12	1	....	....	8	1	1	1	....	....	72	80
Distiller's	2	....	....	1	2	....	1	....	1	....	....	1	....	8	8
Brewer's	....	....	....	....	....	....	1	....	....	....	....	....	....	1	1
Druggist's	....	....	2	1	....	....	....	....	....	....	....	....	....	3	4
Native wine (vino)	332	236	84	202	66	76	44	53	94	21	59	24	18	1,309	1,266
Total	334	272	154	248	77	120	46	75	100	22	61	25	18	1,552	1,565

NOTE.—The above does not include 23 incorporated clubs which pay internal-revenue license tax to serve liquors to their members.

As will be seen by the above statement, the number of licensed liquor establishments in Manila on June 30, 1906, was 13 less than it was on the same date of 1905. There was, however, an increase of 43 in the number of native wine licenses between said dates.

Business licenses.—There are only eight occupations, trades, or professions now subject to the payment of municipal buiness licenses; hence the relatively small collection of only ₱6,770.57 during the last fiscal year as compared with ₱37,518.72 collected under this head during the fiscal year 1905.

Public vehicle licenses.—The collections from this source aggregated ₱13,621.10, or only ₱578.45 less than was collected for the year preceding. From this it would appear that either the electric railway is making very little inroad on the traffic of public vehicles or that the people of Manila are more on the go now than they were before the street cars were installed. There is a constant increase from month to month in the number of vehicle licenses issued. There were licensed during the year 2,079 one-horse rigs, 63 two-horse rigs, and 792 carabao carts; 187 licenses were transferred and 404 duplicates issued.

The quality of the public vehicles has been somewhat improved, as it is the policy of this office to license only such rigs as are in good condition and drawn by healthy looking animals.

Dog licenses.—Receipts from dog licenses during the period covered by this report amount to ₱4,826.50, as compared with ₱9,327.36 collected during the fiscal year 1905, resulting in a loss of ₱4,500.86. The large collections for 1905 are due to the fact that during the months of January, February, and March the police department enforced strict compliance with the provisions of ordinance No. 13, provost-marshal-general, and arrested the owners of all unlicensed dogs. At that time also the poundkeeper took unlicensed dogs from the premises of their owners. This was stopped by the municipal board in April, 1905, since which time the only penalty for failure to procure a license has been to have the dog committed to the pound if found in the streets. There were licensed during the period covered by this report 899 male dogs and 322 female dogs; 306 duplicate licenses and tags were issued and 7 licenses were issued gratis to the consular representatives of foreign countries.

Entertainment and peddlers' licenses.—Receipts under this head for the fiscal year 1906 amount to ₱8,740, as compared with ₱25,126.80 collected during the fiscal year 1905, resulting in a loss of ₱16,386.80. This decrease is due to the repeal of certain municipal license taxes by the provisions of acts Nos. 1189 and 1338, Philippine Commission. Act No. 1189 repealed the provisions of law for issuing licenses to theaters and other places of amusement, and act No. 1338 so amended the license ordinances as to exempt peddlers selling native vegetables, fruits, and foods carried by themselves from the payment of a municipal license tax. At present the only concern subject to a municipal entertainment license is the San Lazaro Racing Club, which pays an annual license tax of ₱200 and a fee of ₱10 for each day that races are run. Races were run on one hundred and fourteen days during the year, which, with the ₱200 annual tax, makes the total annual taxes paid by this club ₱1,340.

Bicycle licenses.—The issuance of bicycle licenses was suspended by direction of the municipal board on January 1, 1906. Between July 1 and December 31, 1905, ₱68.85 had been collected.

Registration of live stock.—This is the only Spanish law imposing municipal taxes that has not been repealed. It is not known whether copies of this law are extant; a copy has never been in the possession of this office. Collections are made by virtue of an order of the provost-marshal-general, which, by the provisions of the Manila charter, was continued in force after the establishment of civil government. Under the existing schedule of charges the fees are so small that the collections hardly pay the expense of enforcing this law. It is impracticable to require proof of ownership, as is done throughout the provinces under the provisions of act No. 1147. It is recommended that the provisions of act No. 1147 be made applicable to Manila. During the year covered by this report 2,925 animals have been registered, at a fee of ₱0.20 each, and 2,008 transfers of ownership have been recorded, at a fee of ₱0.10 each, making a total collection of ₱785.80, as against ₱814.75 for the year 1905.

Vehicle equipment.—The licensee of each public vehicle is required to equip his rig with a disc and staff, number plate, and driver's badge, and pay for the painting of the license number on the lamps. Collections from this source for the year amounted to ₱1,231.30, as against ₱1,536.74 for the fiscal year 1905. The falling off of ₱305.44 is largely due to a system which was inaugurated January 1, 1906, of having duplicate equipments sold direct by the manufacturer to the licensees on an order from this office, instead of having all purchases made through this office. The saving of work to this office and also time and expense to the licensees is believed to fully justify the change of the system in this respect.

Rentals of city property.—There is a slight increase in the collections from this source as compared with the year 1905. A total of ₱18,730.29 was collected, including rentals of the Valderama tenement house. During the fiscal year 1905 ₱18,139.02 were collected from this source. The city of Manila had on June 30, 1906, 123 tenants occupying its various properties, aggregating a monthly rental of ₱1,365. Figured on this basis the annual rental would only be ₱16,380. However, this represents only the regular tenants, and considerable additional revenue is derived from tenants occupying city land temporarily, such as for booths erected during church fairs, etc.

Sale of city land.—The following is a statement of the sales of city land, the purchase price of which this office has collected:

To whom sold.	Date.	Amount.
Ladislao Rivera	July 19, 1905	₱136.20
Roberto Inares	do	106.29
Maria Jurado	Aug. 2, 1905	174.00
Modesta Jurado	do	164.49
Urbano Bustamente	Aug. 3, 1905	99.56
Juliana Trinidad	Aug. 11, 1905	66.00
Domingo Lao	Aug. 19, 1905	133.42
F. F. Du Fresne	Aug. 21, 1905	8.76
José Maria Paris	Sept. 6, 1905	58.58
Olimpio Guanson	Sept. 8, 1905	65.65
Juana Lichauco	Oct. 11, 1905	807.16
Miguel Montenegro	Oct. 18, 1905	370.83
Lucio Ocson	Nov. 16, 1905	177.06
Miguel Montenegro	Dec. 18, 1905	59.40
W. Morley	Feb. 15, 1906	216.90
Total		2,644.30

Weights and measures.—Testing and sealing weights and measures and the collection of fees for such service has been conducted in accordance with the system approved by the municipal board and put into effect in January, 1905. During the year 24,601 different implements and instruments for weighing and measuring have been tested and fees to the amount of ₱6,410.40 have been collected.

Pail conservancy system, water rents, building permits, boiler inspection, and cleaning vaults.—This office has no administrative control over any of the services mentioned above, but makes the collections upon assessment rolls and orders from the department of engineering and public works and from the department of sanitation and transportation of the city of Manila. The receipts from these sources during the year were as follows:

Pail conservancy system	₱59, 327. 16
Water rents	210, 738. 69
Building permits	17, 958. 90
Boiler inspection	1, 218. 00
Cleaning vaults	38, 691. 85
Total	327, 934. 60

Payments of fees for the pail system was changed from a monthly to a quarterly payment on January 1, 1906, payments to be made prior to the 16th of the second month of the quarter. The time of collection proved unsatisfactory, on account of removals during the last half of the quarter, after payments for full quarter had been made, so by resolution of the municipal board the time for collection was changed to the 15th day of the month following the quarter in which the service is rendered. The introduction of this system has made the collections for the year less than they otherwise would have been, inasmuch as these fees for the quarter ended June 30, 1906, are collectible during the first fifteen days of July, 1906, while in the preceding years there remained to be collected during July June accounts only.

Of the above-mentioned items the following show increases as compared with collections made during the fiscal year 1905:

Pail system	₱22, 684. 29
Building permits	217, 083. 00
Vault cleaning	7, 753. 89
Total	247, 521. 18

A loss is shown in the collections on account of boiler inspection of ₱264.

Fees, fines, costs, etc.—Costs, fines, fees, etc., were received under the provisions of section 61 of the Manila charter from the several officials charged with their collection. The amounts received from these sources during the year were as follows:

Municipal-court collections	₱68, 500. 77
Sheriff's fees	13, 689. 36
Justice of peace, fines and fees	6, 757. 90
City attorney's fees	192. 26
Pound receipts	4, 077. 00
City electrician's fees	7, 868. 70
Cementerio del Norte	13, 425. 09
Secretary of the municipal board, fees	69. 00
Public health, fees (burial fund)	15, 048. 00
Total	129, 628. 08

Of these items the following show the following increases as compared with collections for the fiscal year 1905:

Sheriff's fees	₱912. 99
Justice of peace's fees	899. 59
City electrician's fees	4, 069. 40
Cementerio del Norte	11, 540. 71
Secretary of the municipal board, fees	28. 50
Total increases	17, 451. 19

The following show losses as indicated:

Municipal court fines	₱26,449.57
City attorney's fees	197.86
Pound receipts	659.70
Public health fees	740.04
Total decreases	28,047.17
Net decrease	10,595.98

The collection of electrician's fees is now being made by this office instead of by the city electrician as heretofore.

Transportation of meat.—Receipts under this head are for services rendered by the department of sanitation and transportation for delivering meat from the slaughterhouse to the various markets in the city, and is in accordance with a resolution passed by the municipal board in February, 1906, by which the city delivers this meat at the rate of ₱0.07 per quarter. Prior to that date meat was delivered by contractors at rates ranging from 7½ to 12 centavos per quarter. Since this change in the system there has been collected the sum of ₱3,370.74. While the administration of this system is with this office, the city department of sanitation and transportation defrays all of the expenses incident to the delivery of the meat.

Miscellaneous collections.

From whom collected.	Date.	Total.
	1905.	
United States Quartermaster's Department, for installation of water meters, for the military government	July 1	$595.46
Faustino Lichauco, for 80 cubic meters of broken stone, at ₱1.94	July 6	155.20
J. G. White & Co., for repairing drain obstructed by a pole on Calle Globo de Oro, Quiapo	July 3	79.67
J. G. White & Co., for repairing drain obstructed by a pole on Calle Echague, Quiapo	July 13	45.21
Bilibid Prison, for one length of sewer	July 14	19.20
Manila Telephone Co., 7 per cent of gross earnings for quarter ending June, 1905.	July 17	1,000.39
Gonzalo Tuason, for repairing obstructed sewer on Calle Escolta, Binondo	Aug. 15	24.37
Gutierrez & Co., for cleaning obstructed sewer on Calle Escolta, Binondo	...do...	22.00
Faustino Lichauco, for 100 cubic meters stone, at ₱1.94	Aug. 18	194.00
Rafael Perez, for installing sewer on Calle Anloague	Sept. 21	75.53
Dominican Fathers, for cleaning sewer on P. Moraga	Sept. 23	7.38
Trinidad Jurado, for cleaning private sewer at No. 9 Calle Legaspi, Intramuros	Oct. 13	11.07
C. H. Lanman, for cleaning private sewer at No. 28 Calle Palma, Quiapo	Oct. 14	6.40
J. G. White & Co., for repairing private sewer on Calle Sinagoga, Malate	Oct. 17	18.40
Fernandez Hos, for installing sewer at No. 4 P. Moraga	Oct. 19	228.98
Fernandez Hos, for installing sewer at No. 176 Jaboneros	...do...	128.76
Manila Telephone Co., 7 per cent of gross earnings for quarter ending September, 1905	Oct. 25	1,106.00
Vda. de Perez Rubio, for cleaning and repairing private sewer at No. 6 San Luis, Ermita	Nov. 7	17.52
Frank A. Branagan, treasurer of the Philippine Islands, estates of— Patrick J. Sullivan, deceased ₱249.94 Stephen B. Wilson, deceased 106.65 William L. Franks, deceased 1.90	Nov, 15	358.49
J. E. Harding, chief of police, proceeds of auction sale of confiscated, found, and stolen property	Nov. 24	135.52
Jno. N. Tuther, dividend of Banco Español-Filipino	Dec. 21	2,834.46
	1906.	
La Insular Cigar Factory, for cleaning and repairing an extension of private sewer Calle Duque	Jan. 19	145.00
Manila Telephone Co., 7 per cent of gross earnings for quarter ending December, 1905	Jan. 24	423.21
C. de P. P. Dominicans, for repairing sidewalk	Feb. 1	26.69
Rafael Moreno, for cleaning sewer No. 183, Cabildo	Feb. 3	5.26
Gregorio Mariano, for cleaning sewer No. 47, Barbosa	Feb. 10	25.35
J. G. White & Co., for repairing sewer, Calle Santa Rosa	Feb. 16	12.67
J. G. White & Co., for repairing sewer, Calle Enrile	...do...	50.42
J. G. White & Co., for repairing sewer, Calle San Pedro	...do...	35.48
J. G. White & Co., for repairing sewer, Calle Arlegui	...do...	7.00
J. G. White & Co., for repairing sewer, Calle Palma	...do...	37.76
J. G. White & Co., for repairing sewer, Calle Enrile	...do...	16.60
B. Hernandez, for sewer repair No. 8, Caballeros	Feb. 24	23.08
Manuel Sequera, for connecting house to drain on Calle Mendoza, Quiapo	Mar. 2	66.97

Miscellaneous collections—Continued.

From whom collected.	Date.	Total.
Philippine Islands Telephone and Telegraph Co., for repairing drain on Calle Echague	1906. Mar. 8	$17.51
Do	Mar. 20	17.41
Faustino Lichauco, for 200.11 cubic meters crushed stone	Mar. 13	388.21
Atlantic, Pacific and Gulf Co., for repairing paving on Rosario	Mar. 20	64.29
B. W. Cadwallader & Co., for 1,000.11 cubic meters crushed stone	Apr. 7	2,130.23
Faustino Lichauco, for 426.74 cubic meters screenings	Apr. 14	908.95
H. E. Stafford, for building sidewalk, G. Solano	Apr. 19	53.55
J. G. White & Co., for repairing sewer, Santa Rosa	Apr. 23	21.98
Manila Telephone Co., 7 per cent gross earnings for quarter ending March, 1906	Apr. 27	851.64
Ramon B. Genato, for sewer repair, Calle Concepcion	May 2	19.20
P. P. Dominicans, for cleaning sewer, P. Moraga	May 18	14.56
Tomas Guison, for installing sewer at Elks Club	May 21	53.06
J. E. Harding, chief of police	June 15	271.35
Faustino Lichauco, for 502 cubic meters screenings	June 4	1,069.26
Total		13,811.70

Internal-revenue dividends.—This source of revenue to the city comprises the entire collections from the sale of cedulas in Manila, the entire receipts for licenses issued for the maintenance in Manila of theaters, museums, concert halls, pawnbrokers, circuses, and billiard rooms, and Manila's share, in proportion to its population, of the 25 per cent of the revenue accruing to the insular government under the provisions of the internal-revenue law, apportioned for the use of provincial and municipal governments. There has been received from the auditor during the fiscal year ended June 30, 1906, the sum of ₱74,876.93 from this source, representing the dividends on account of collections made from April 1, 1905, to December 31, 1905, as follows:

25 per cent of the revenue accruing to insular government according to population	₱36,602.93
Cedulas	27,229.00
License taxes enumerated above	11,045.00
Total	74,876.93

In preparing his estimate for the fiscal year 1906 of receipts from this source, the city assessor and collector anticipated that dividends would be received during the year for four quarters, April 1, 1905, to March 31, 1906. The dividend for the quarter ended March 31, 1906, which it is estimated will be the largest yet received, has not as yet been paid by the auditor.

Manila Electric Railroad and Light Company—Franchise tax.—By the provisions of its charter the Manila Electric Railroad and Light Company pays to the city of Manila 2½ per cent of its gross earnings from fares collected, tickets sold, and electric light and power sold. In consideration of the payment of this franchise tax the company is exempted from the payment of all other taxes except the real estate tax. The sum of ₱28,662.85 was collected from this company during the fiscal year 1906, representing twelve monthly payments. A comparison with the collections for the fiscal year 1905 would be valueless, as the company only began operations in April, 1905.

TOTAL COLLECTIONS.

As will be seen by the statement below, the total collections of city taxes, fees, charges, etc., amount to ₱2,465,780.40 for the fiscal year 1906, as compared with ₱2,875,599.83 for the fiscal year 1905, a decrease of ₱409,819.43. Notwithstanding this falling off in the total collections, gains are shown in practically every item which has not been affected by repealing statutes or by limitations of law or by the resolutions of the municipal board. The loss occurs principally in collections on account of industrial taxes, stamp sales, sales of cedulas (which loss would have been offset by receipts from internal-revenue dividends if the dividend for the quarter ending March 31, 1906, had been received before the close of the year), municipal licenses, vehicle taxes, and market fees.

Source of revenue.	Receipts, fiscal year—		Per cent of total.	Estimated receipts for fiscal year 1907.
	1905.	1906.		
Land tax	₱1,152,580.17	₱1,208,265.31	49.001	₱1,250,000.00
Industrial tax	304,021.64	1,191.81	.040	....
Certificates of registration (old law)	22,143.00	846.00	.035	....
Stamp sales (old law)	81,423.94	....	....	....
Matadero tax	169,353.00	160,049.25	6.490	160,000.00
Market tax	304,916.34	269,430.88	10.930	260,000.00
Licenses	289,764.54	217,958.16	8.840	240,000.00
Live-stock registration	814.75	785.80	.033	750.00
Vehicle tax	24,460.47	....	....	....
Vehicle equipment	1,536.74	1,231.30	.050	1,000.00
Rents, city property	18,139.03	18,730.29	.760	20,000.00
Municipal court fines	94,950.34	68,500.77	2.780	70,000.00
Pail system	36,642.87	59,327.16	2.407	70,000.00
Vault cleaning	30,937.96	38,691.85	1.570	30,000.00
Weights and measures	6,388.80	6,410.40	.260	900.00
Water rents	196,320.51	210,738.69	8.547	220,000.00
Building permits	15,788.07	17,958.90	.730	20,000.00
Boiler inspections	1,334.00	1,070.00	.043	1,200.00
Board of health	15,788.04	15,048.00	.610	15,000.00
Justices of peace fees	5,858.31	6,757.90	.275	6,000.00
Sheriff's fees	12,776.37	13,689.36	.551	12,000.00
City attorney	390.12	192.26	.008	400.00
City electrician	3,799.30	7,868.70	.320	8,000.00
Secretary of municipal board	40.50	69.00	.003	50,00
Pound receipts	4,736.70	4,077.00	.166	4,000.00
Miscellaneous	6,011.65	13,811.70	.560	10,000.00
Sales of city land	3,368.54	2,644.30	.108	50,000.00
Cementerio del Norte	1,884.38	13,425.09	.540	7,500.00
Franchise tax (Manila Electric Railroad and Light Company)	2,396.18	28,662.85	1.163	34,000.00
Internal-revenue dividend	67,033.57	74,876.93	3.040	205,000.00
Transportation of meat	....	3,470.74	.140	8,500.00
Total	2,875,599.83	2,465,780.40	100.000	2,704,300.00

From the above statement it will be seen that only 59 per cent, or ₱1,456,924.13, of the total city collections represent receipts from municipal taxes; that 3 per cent, or ₱74,876.93, represent receipts from internal-revenue taxes; that 38 per cent, or ₱933,979.34, represent receipts for services rendered, fees, rents, sales of lands, court fines, etc.

EXPENSES.

The actual net expense during the year for the collection of the city revenues which was borne wholly by the city of Manila, is as follows:

Salaries and wages	₱89,011.04
Contingent expenses	15,467.15
Total	104,478.19

or a fraction over 4.2 per cent of the total collections.

TAX REFUNDS.

The following is a statement of refunds of municipal taxes that have been made during the year:

Industrial taxes, to insurance companies and banks, representing the amounts paid for the last four months of the calendar year 1904 (act No. 1338, Philippine Commission)	₱13,672.49
Municipal licenses, refunds made on account of repeal by act No. 1189, Philippine Commission, of the law, on January 1, 1905, under which the licenses were issued; refunds represent value of unexpired licenses on that date	11,424.34
Real estate tax	7,334.65
Vehicle tax refunds made on account of collections made for calendar year 1905 during 1904, collection of said tax having been suspended on December 28, 1904	282.50
Ground rent	11.00
Industrial taxes; to distillers (act No. 1257, Philippine Commission). These refunds were made by the auditor	986.01
Total	33,710.99

PART 3.

MISCELLANEOUS.

I. OPIUM TAXES.

[Collected under authority of act No. 1461, Philippine Commission.]

This law is entitled, "An act for the purpose of restricting the sale and suppressing the evil resulting from the sale and use of opium until March first, nineteen hundred and eight, when its importation or use for any but medicinal purposes is forbidden by act of Congress." It was enacted by the Philippine Commission, after public discussion, on March 8, 1906, and was made effective April 1, 1906. This bureau was charged with its enforcement and with the collection of the license and other taxes, imposed by its provisions, through the various agencies charged with the collection of the internal-revenue taxes imposed in act No. 1189.

Due to the limited time between the date the law was enacted and the end of the fiscal year, it was impracticable to provide register books and blank forms to any of the provinces, but in Manila the administrative machinery was installed during the month of June. The statement herein of collections therefore includes only receipts from the various taxes collected in Manila, and a few in the provinces.

Immediately after the enactment of the opium law all internal-revenue agents and provincial treasurers were instructed to locate and report to this office all opium dens, opium dealers, and users of opium. The data thus secured was used, when the director of printing had delivered the record books, licenses and forms, to register persons subject to these taxes in every part of the islands. Pending the receipt of the printed forms temporary methods were devised. At the date of making this report the permanent forms are in use in nearly every locality and the opium taxes are being collected by the purchase, affixture, and cancellation of internal-revenue stamps to licenses and invoices in the manner provided by law. Regulations have also been issued for the guidance of internal-revenue officers.

As provided by law, declarations were required from all dealers in opium, showing the quantity and kind of opium in their possession on April 1, 1906. In Manila these declarations were secured by the regular force of agents, and by clerks specially detailed as agents, on the night of March 31, and during the two days next following. These officers visited the places of business of all persons supposed to have opium in their possession. Two hundred and eighty-five persons and firms were found with opium in their possession, aggregating 5,301 kilograms of crude opium, 1,811 kilograms of opium prepared for smoking, and 16 kilograms of alkaloids of opium, a total of over seven tons found in Manila alone. The declarations of opium on hand made by the dealers in the provinces materially increased the Manila total. The totals for the entire islands now are as follows: Seven hundred and thirty-four persons and firms had opium in their possession, aggregating 6,802 kilograms of crude opium, 2,448 kilograms of opium prepared for smoking, and 30 kilograms of alkaloids of opium, making a total of 9,281 kilograms, equal to about ten tons, of opium on hand and declared for taxation on April 1, 1906, when the law took effect.

Taking as a basis for estimate the customs figures of duty-paid opium, imported into the Philippine Islands during late years, it would appear that the normal annual amount of opium smoked here has been over one hundred tons, the retail sale price of which has been about ₱5,000,000. The 10 tons found in existence by internal-revenue officers on April 1, 1906, would therefore supply the normal demands of smokers in these islands for about five weeks. The amount of duty-paid opium imported since April 1, 1906, has been far from normal, i. e., what it had been prior to that date. The inference would be: (1) that opium merchants and smokers had stocked up before the law became effective taxing imports and were able to conceal the larger portion of the drug from the scrutiny of internal-revenue agents and other officers who made the assessment of opium stocks on April 1, 1906; (2) that opium in considerable quantities is at present being smuggled into these islands in such manner as to evade the customs inspectors; (3) that the majority of persons who formerly smoked, or otherwise used opium, have now reformed. The apparent decrease in the consumption of the drug may be due to any one of these three causes, or may be due, partly, to each of the three. It is, as yet, too early to make any positive assertion. Prepared opium is a precious article—is in fact worth its weight in silver; it is quite the custom for some retail dealers to use a Philippine silver peso in one side of their balance scales with which to weigh a peso's worth of opium in the other. The ease with which small quantities of prepared opium can be concealed by passengers on incoming boats or by importers, merchants, and consumers, from scrutiny by customs and internal-revenue officers can readily be understood. Taken in the aggregate these petty frauds undoubtedly represent a large portion of the opium actually smoked or otherwise consumed in these islands; just how large it is, of course, in the nature of things, impossible to even estimate with any degree of approximation.

Temporary system.—Immediately upon the law taking effect a temporary system of records and tax payments was put into operation in order that no hardship might be imposed upon dealers and users while the permanent record books and forms were being printed. Habitual users' certificates were put on sale in Manila on April 1 and in the provinces as soon thereafter as possible. Dealers were required to keep improvised register books, but were permitted for a limited period to sell opium to all Chinese persons regardless of whether or not they had secured an habitual user's certificate. For the purpose of identification they were, however, required to enter in their provisional registers the number of the immigration registration certificate of each Chinese person to whom they sold opium.

Those persons having opium in their possession, and not desiring to become dealers and pay the license taxes, were required to deposit all opium in their possession with the collector of internal revenue in Manila and with the proper provincial treasurer in the provinces. Opium thus deposited was held until the ownership was transferred to a regularly licensed dealer.

Habitual users' certificate.—The provisions of the opium law with regard to the certificate required by habitual users were published, both by the consul-general of China and by this office, by the distribution of circulars printed in Chinese and by other means. But notwithstanding these notices a number of violations of the law were detected during the month of April and several arrests were made. The majority of those arrested claimed that they were too poor to pay the ₱5 fee provided for the habitual user's certificate and that they could not stop the use of the drug. Effort was then made to secure free hospitalization for these unfortunates, as contemplated by the law. Some difficulty was at first encountered, and in view of the great hardship and physical suffering which would result through a strict enforcement of the law before free medical treatment had been provided it was decided, with the approval of the secretary of finance and justice, to make no more arrests of persons using opium without an habitual user's certificate until the matter of free hospitalization could be arranged. This was accomplished late in June, and since that date Chinese persons who, not having an habitual user's certificate, are found smoking opium are arrested and required to at once do one of two things, take out a certificate and pay such fine as the court may impose or enter some hospital as a bona fide patient and be cured of the use of the drug. Filipinos, Americans, and others not Chinese persons can not be issued a user's certificate. Their only alternative from prosecution in court is hospital treatment. The director of health and his assistants have cooperated heartily with the officers of this bureau in this work and in suppressing the evils of drug using.

From April 1 to June 30, 1906, there were issued 4,845 habitual users' certificates at ₱5 each, making a total collection from this source of ₱24,225. Of this number, 2,519 were issued in Manila and 2,326 in the provinces. Estimates of Chinese and other persons who claim to have some knowledge of the true facts are that the number of Chinese persons smoking and otherwise using opium in the islands ranges from 10,000 to 40,000. It is believed that probably 20,000 confirmed users of opium will eventually take out users' certificates, either because they prefer not to be cured or because they believe they can not be cured. The provisions of law restricting the sale of opium to registered users, and, in special cases, on the prescription of a practicing physician, are being more tightly drawn every day in every part of the islands. Chinese persons not intending to be cured will soon have to register as habitual users. A large number of Filipinos and some few Americans and foreigners have applied for user's certificates, which, of course, were not issued, as the law restricts the issue of these certificates to Chinese persons.

License taxes.—There were issued between April 1 and June 30, 35 wholesale dealers' licenses and 134 retail dealers' licenses, of which 20 of the wholesale and 75 of the retail were issued in Manila. From the information gathered by internal-revenue agents during the period between the date of the enactment of the law and of its taking effect there were 315 places in Manila where opium was sold, exclusive of drug stores. There were on June 30, 1906, only 78 such places. Some dealers have taken out both a wholesale and a retail license. The amount collected from wholesale licenses is ₱8,752.10, from retail licenses ₱6,703.90, making a total collection from this source of ₱15,456.

Tax on opium.—The taxes collected on crude opium, opium prepared for smoking, and alkaloids of opium in the hands of dealers on April 1, 1906, amounted to ₱22,391.58. The taxes collected on opium imported subsequent to April 1 amounted to ₱9,132.95. The taxes collected on opium prepared subsequent to April 1 amounted to ₱10,219.36. These all represent Manila collections; the record books and forms have only recently been installed in the provinces, and reports of collections made in the various provincial towns are not as yet available.

Résumé of collections.—The amount of taxes collected during the three months ending June 30, 1906, is distributed as follows:

Habitual users' certificates	₱24, 225. 00
Wholesale dealers' licenses	8, 752. 10
Retail dealers' licenses	6, 703. 90
Taxes on opium in hands of dealers April 1, 1906	22, 391. 58
Taxes on opium imported since April 1, 1906	9, 132. 95
Taxes on opium prepared since April 1, 1906	10, 219. 36
Total	81, 424. 89

The amounts collected as cost of printing blank forms are included under the various subheads.

Pharmacists—patent medicines.—Register books, blank forms, and regulations for pharmacists dealing in opium and preparations containing opium for medicinal purposes have not as yet been issued, but are now being prepared with the assistance of the officials of the bureau of health and of the bureau of science. It has become necessary to determine by laboratory analysis whether certain proprietary and other medicinal preparations now on the market should be considered as opium for the purposes of the law. When these analyses have been completed, the results will be communicated to the insular collector of customs, in order that the tax on imported preparations of opium may be collected, and necessary instructions will also be issued by this office to pharmacists and druggists regarding the sale of such opium preparations to the public. In order that no unnecessary hardship may be imposed, internal-revenue officers have been instructed to temporarily permit pharmacists to sell, in cases of emergency, laudanum and other medicinal preparations containing opium, without requiring the purchaser to present either an habitual user's certificate or the prescription of a practicing physician.

II. SAN LAZARO ESTATE RENTALS.

The collection of these rents, which until March 31, 1906, had been made by the bureau of lands, devolved on this bureau on April 1, 1906, in accordance with executive order No. 15, dated March 12, 1906, as follows:

"On and after April first, nineteen hundred and six, all of the authority now vested in the director of lands for the collection of rents and other income from the property of the estate of the San Lazaro Hospital shall be vested in the collector of internal revenue, and so much of executive order numbered seven, series of nineteen hundred and one, as amended by executive order numbered one hundred and eleven, series of nineteen hundred and two, as relates to the collection of rents and other income of said estate is hereby revoked. Except as herein provided, the director of lands will continue to perform all of the duties now vested in him as administrator of the estate of the San Lazaro Hospital.

"HENRY C. IDE,
"*Acting Governor-General.*"

Tenants of the San Lazaro estate delinquent in the payment of their rentals have been called on, by written notices and otherwise, to call at this office and pay without further delay. The results have been fairly satisfactory, the following being a résumé of the work accomplished during the three months ended June 30, 1906, that this bureau has been charged with these collections:

Number of tenants April 1, 1906	2,293
Number dropped from rent roll	17
Number added to rent roll	64
Number of tenants June 30, 1906	2,340
Amount collected	₱16,044.50
Number of tenants delinquent June 30, 1906	508
Amount delinquent June 30, 1906	₱8,580.65

III. DELINQUENCY CHARGES AND FORFEITURES.

In various sections of act No. 1139 it is provided that delinquencies in the payment of the internal-revenue taxes, petty frauds, etc., shall be punished by the forfeiture of goods illicitly removed, or of an amount equal to the value thereof, or by fines in small amounts administratively imposed. It is also provided that these fines, etc., shall be collected and accounted for in the same manner that the internal-revenue taxes themselves are required to be collected and accounted for by the various provisions of the internal-revenue law. A summary of the amounts thus collected during the fiscal year ended June 30, 1906, is given below; these amounts have already been included under the various heads, in Part 1 of this report, as tax collections, and they are here segregated merely for ease of reference:

On alcohol and tobacco products illegally removed	₱9,191.10
Delinquent license payments by dealers in alcohol and tobacco products	30,818.39
Delinquent license payments by merchants	20,486.96
Delinquent license payments upon professions and occupations	12,462.33
Total	72,958.78

IV. LOCAL CURRENCY.

Certain duties were imposed on this bureau by the provisions of act No. 1045, enacted by the Philippine Commission on January 27, 1904, with regard to the registration in this office of all contracts payable in the old currency, not on a gold basis, in use in these islands prior to the establishment of the new Philippine currency, with the collection of a stamp tax on all documents containing a money consideration in terms of the old currency, and with preventing, on and after January 1, 1905, the use in the channels of trade of any of the old currency, which consisted principally of Mexican dollars, and other foreign fractional silver and copper pieces. The work of preventing the use of these old coins was assigned to the internal-revenue agents and officers in the field who were directed to visit all stores, warn the merchants, and report to this office those who continued to accept the old currency in trade. On December 27, 1904, a notice was issued from this office, printed in Spanish and in the various dialects, and widely distributed throughout the islands. The English text of the notice follows:

"THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
"DEPARTMENT OF FINANCE AND JUSTICE,
"BUREAU OF INTERNAL REVENUE,
"*Manila, P. I., December 27, 1904.*

"For the purpose of enforcing compliance with the provisions of act No. 1045 of the Philippine Commission, all persons, firms, and corporations in the Philippine Islands are hereby notified as follows:

"1. That local currency, including Mexican coins, Spanish and Spanish-Filipino coins, and all other metallic moneys not upon a gold basis, and all bank notes payable in said moneys will not be lawful money in the Philippine Islands on and after January 1, 1905.

"2. That any person, firm, or corporation who engages in any business whatsoever in the Philippine Islands on or after January 1, 1905, and makes use of local currency to any extent whatsoever in either buying, selling, or renting goods, property, or services, must, previously to engaging in such business, and annually thereafter, in addition to the other licenses required by law, obtain a license from the collector of internal revenue, in the manner prescribed under the provisions of section 11 of act No. 1045.

"3. The annual license taxes imposed for the use of local currency in any business whatsoever on or after January 1, 1905, are in the following amounts:

"*Class 1.*—₱10,000 for the transaction of such business in any of the following towns: Manila and its suburbs.

"*Class 2.*—₱5,000 for the transaction of such business in any of the following towns: Malabon, Navotas (Rizal), Iloilo, Jaro, Molo (Iloilo), Cebu (the capital), Cavite (the capital), Dagupan (Pangasinan), Sorsogon (Sorsogon), Batangas, Lipa (Batangas), Nueva Caceres (Ambos Camarines), San Fernando (Pampanga), and other towns of over 30,000 inhabitants.

"*Class 3.*—₱1,000 for the transaction of such business in any of the following towns: Tayabas (the capital), Lingayen (Pangasinan), Catbalogan (Samar), Capiz (the capital), Albay, Legaspi, Tabaco (Albay), Santa Cruz (Laguna), Tacloban (Leyte), Vigan (Ilocos Sur), San Isidro (Nueva Ecija), Ilagan (Isabela), Bacolod, Silay (Negros), Tuguegarao, Aparri (Cagayan), Guagua (Pampanga) Zamboanga (the capital), and towns of from 15,000 to 30,000 inhabitants.

"*Class 4.*—₱500 for the transaction of such business in any town not included in classes 1, 2, or 3.

"That engaging in any such business without the prepayment of this license tax is made a criminal offense by the provisions of act No. 1045, the punishment of which is, in addition to the payment of the license tax, a fine not to exceed an amount equal to 10 per cent of such tax. Each separate transaction in local currency contrary to law constitutes a separate offense, and subjects the offender to an additional fine. That petty traders and poor people who transact such business without having paid the license tax thereon, because of ignorance of their duty to pay such license tax, shall be subject to the payment only of the fine, and in such case the amount of the fine, for the first offense in each case, shall not exceed ₱10, Philippine currency, and costs.

"4. That all persons, firms, or corporations purchasing local currency with the sole purpose and effect of promptly shipping such local currency out of the Philippine Islands are exempted from the payment of the license taxes above mentioned. But every such person, firm, or corporation, prior to engaging in such purchase of local currency, shall file with the collector of internal revenue a sworn statement as to his intention of engaging in the purchase of such local currency for the purpose of its shipment out of the Philippine Islands and shall obtain from the collector of internal revenue written permission to engage in such business without the payment of said license taxes.

"5. That every check, note, draft, bond, bill of exchange, and every contract whatsoever, payable wholly or in part in local currency and drawn or made or transferred or indorsed on or subsequent to October 1, 1904, should bear upon its face an internal-revenue stamp or stamps of a face value in Philippine currency equal to the amounts hereinafter provided, said stamp or stamps to be properly canceled at the time of the signing, transfer, or indorsement of said check, note, draft, bond, bill of exchange, or contract, as follows:

"(a). An ad valorem rate of 1 per cent levied in Philippine currency upon the face value in local currency of each aforementioned instrument drawn or made during the month of October, 1904.

"(b) An ad valorem rate of 2 per cent levied in Philippine currency upon the face value in local currency of each aforementioned instrument drawn or made during the month of November, 1904.

"(c) An advalorem rate of 3 per cent levied in Philippine currency upon the face value in local currency of each aforementioned instrument drawn or made during the month of December, 1904.

"(d) An ad valorem rate of 5 per cent levied in Philippine currency upon the face value in local currency of each aforementioned instrument drawn or made subsequent to December 31, 1904.

"6. That a tax of 1 per cent per month in Philippine currency is imposed upon the average daily balance of each deposit of local currency held after December 31, 1904, by any bank, corporation, or individual receiving deposits held for the purpose of keeping funds for the payment at a future date of a bona fide specific local-currency obligation reduced to writing prior to October 1, 1904, and which have been exempted by express permission in writing by the secretary of finance and justice and have been registered with the collector of internal revenue prior to December 31, 1904.

"7. That this office will, on and after January 1, 1905, enforce a strict compliance with all of the provisions of law above enumerated through the internal-revenue officers of this bureau. That by 'internal-revenue officers' as used in this notice shall be understood all internal-revenue agents of this bureau, all provincial treasurers and their authorized deputies, and, in the city of Manila, the city assessor and collector and his authorized deputies. The necessary instructions have been issued to the city assessor and collector of Manila and to in the collection of the unpaid license taxes, the unpaid stamp taxes on instru- all provincial treasurers regarding the method of procedure they are to follow ments, and of the fines imposed by act No. 1045 on persons, firms, and corporations engaged in illegal transactions in local currency, or who may have failed to affix internal-revenue stamps to any written instruments made subject thereto at the time of the issue, transfer, or indorsement of any such instruments by any such person, firm, or corporation.

"8. That persons, firms, or corporations who take out the license provided in section 11 of act No. 1045, authorizing them to engage in transactions in local currency, on and after January 1, 1905, will also be required to pay, in addition to such license taxes, the taxes imposed in section 139 of act No. 1189 of the Philippine Commission, known as 'the internal-revenue law of 1904,' at the rate of one-third of 1 per cent of the value in Philippine currency of all local currency used by them in the transaction of the business for which such license is issued.

"JNO. S. HORD,
"*Collector of Internal Revenue.*"

Registered contracts, etc.—Prior to October 1, 1904, there were registered in this office, under the provisions of section 9 of act No. 1045, accounts, notes, leases, bonds, insurance policies, and other contracts reduced to writing, payable in local currency, amounting to the sum of ₱8,031,667.12. The foregoing represents those written contracts which the parties thereto were unable to reduce to local currency prior to the date fixed; however, the above were soon changed to Philippine currency, and before the end of the fiscal year ended June 30, 1905, practically the whole number had been changed. While certain of the contracts above named were settled in the various courts, there is not a case reported to this office in which the parties thereto were unable to make a settlement of the consideration out of court, or that the fact that there had been a change in the currency had caused the settlement to be taken into court. While many of said contracts were paid in local currency, the majority were settled upon a Philippine currency basis, by the parties thereto accepting the value of the two currencies as estimated by the insular treasurer and bankers of the city of Manila.

Registered purchasers of local currency for export.—During the month of January, 1905, this office registered the names of thirty-eight persons or firms in the Philippine Islands (other than bankers) who declared their intention to purchase local currency with Philippine currency for the purpose of its export or sale to the government. All of said persons or firms were required to procure a license under the provisions of paragraph 1 of section 144 of act No. 1189. Twenty-two of said licenses were for business to be done in the city of Manila and the remainder for the provinces. All were required to file a sworn statement promising strict compliance with all the provisions of act No. 1045, and render reports to this office of their transactions in local currency.

Prosecutions.—On November 8, 1904, this office caused the arrest of one person for violating paragraph 1, section 6, of act No. 1045; said defendant was fined ₱75. During 1905 two persons were prosecuted for violating section 11 of said act; one was acquitted and the other paid a fine of ₱500.

Exportation of old coins.—The following is taken from the record kept in this office of the value of the local currency exported commercially since the passage of act No. 1045:

During the fiscal year ending June 30, 1905	₱4, 144, 369
Six months ending December 31, 1905	162, 776
Three months ending March 31, 1906	117, 240
Three months ending June 30, 1906	82, 114

The above does not include Mexican currency exported by the government for recoinage. It is evident that those who had been hoarding their old coins for purposes of speculation are gradually letting them go. The sharp drop in the value of the coins exported from quarter to quarter indicates that they will soon be entirely withdrawn to other countries. The present rate of exportation of these coins commercially is less than an average of ₱1,000 per day.

Enforcement of the law.—Reports were frequently received in this office of the use of local currency throughout the islands during all of the calendar year 1905, but the investigations which were promptly made proved in each case that such reports were false, or that some small dealer had accepted a few of the old copper coins in trade, and when detected would immediately exchange such coins for Philippine currency, and upon sworn promises not to again make use of the old currency would not be prosecuted.

During the past six months the reports of all internal-revenue agents and officers have been that no local currency is being used in trade in their respective districts. The new Philippine currency is flowing smoothly in all channels of trade, even in the most insignificant commercial transaction in the most remote municipalities and barrios in these islands.

V. REDEMPTION AND DESTRUCTION OF OLD SPANISH STAMPS.

Executive Order No. 9, dated February 13, 1905, is as follows:

"Pursuant to the recommendation of the collector of internal revenue and the auditor for the Philippine Islands, the city assessor and collector of the city of Manila is hereby authorized and directed to redeem all internal-revenue stamps sold prior to January first, nineteen hundred and five, under the provisions of the royal decree of Spain dated May sixteenth, eighteen hundred and eighty-six, and now in the hands of the public unused.

"Said stamps shall be redeemed by the exchange in equal money value of the new series, if presented to the city assessor and collector of the city of Manila, or to any provincial treasurer, prior to May first, nineteen hundred and five, and the redemption thereof shall be in accordance with such regulations as may be prescribed by the city assessor and collector and approved by the collector of internal revenue and by the auditor for the Philippine Islands.

"LUKE E. WRIGHT,
"*Governor-General.*"

Pursuant to these instructions the assessor and collector of the city of Manila was directed to call on the holders in Manila of the old series of Spanish documentary stamps to surrender to him all such stamps and to receive in lieu therof equivalent values of documentary stamps of the new series printed under the provisions of act No. 1189, the internal-revenue law. Simultaneously instructions were issued from this office to all provincial treasurers to redeem in a similar manner all such old-series stamps found in their respective districts, to send all such redeemed stamps to the assessor and collector of the city of Manila, and to receive from him equivalent values of stamps of the new series.

This office furnished the assessor and collector from time to time, on requisitions, sufficient stamps to make the redemptions in Manila and to replace the stamps used by provincial treasurers to redeem stamps in their districts. May 1, 1905, was the date set in Executive Order No. 9 when the redemption of these old-series stamps could no longer be made. A few requests have come in since that date requesting the redemption of old stamps, but the values held were in all cases quite small. The executive secretary had meanwhile appointed a committee of three persons as a "special inspection committee for the purpose of supervising the destruction, by burning, and reporting upon from time to time of certain unused obsolete internal-revenue stamps and stamped paper now being turned in to the city assessor and collector by provincial treasurers" and by sundry other persons in the city of Manila for redemption. And as further amended "so as to permit of the destruction of the 'mother stone' and the electrotype plates and recommendation as to the disposition of the stamped paper. Further, to count, verify, give the denomination and face value of all old obsolete stamps and stamped paper of the series used prior to January 1, 1905, now held in stock by Mr. A. W. Hastings, city assessor and collector, Manila, P. I., and for which he is accountable." Said committee on June 21, 1905, reported that they had counted all of the old-series stamps redeemed and held by the assessor and collector of the city of Manila, and of all old stamps and stamped paper held by him in stock, and that the committee witnessed the burning of all said stamps and stamped paper, and had absolutely destroyed the "mother stone" and electrotype plates used in the printing of said old-series stamps and stamp paper.

On August 3, 1905, the assessor and collector of the city of Manila reported as follows:

"THE COLLECTOR OF INTERNAL REVENUE,
"*Manila, P. I.*

"SIR: I have the honor to inclose herewith one copy of the approved report of the inspection committee, convened under Executive order dated May 23, 1905, as amended by order dated June 5, 1905, determining the disposition of certain internal-revenue stamps, etc., property of the insular government, and for which I was accountable.

"And to request that you issue to me the following documentary stamps of the new issue to replace those of the old issue, which are shown by the report to have been exchanged for the provincial treasurer and sundry persons, viz:

39,381, at 2 centavos	₱787.62
50,000, at 4 centavos	2,000.00
5,000, at 10 centavos	500.00
7,500, at 20 centavos	1,500.00
Total	4,787.62

"Very respectfully,

"A. W. HASTINGS,
"*City Assessor and Collector.*"

Complying with this request, documentary stamps of the new series were issued by this office to the city assessor and collector in the amount given above; and a credit was given to the account of the collector of internal revenue on the insular auditor's books for an equal amount, inasmuch as the stamps thus issued did not represent tax collections, but were used exclusively to redeem stamps of the old series rendered obsolete by the provisions of act No. 1189.

CONCLUSION.

During the fiscal year for which this report is made the responsibilities of this bureau have been increased by various acts of the Philippine Commission and executive orders of the governor-general. Act No. 1407, the reorganization act, imposed on this bureau, since October, 1905, the assessment and collection of the taxes on forest products, which prior thereto had been the work of the director of forestry, and since January 1, 1906, the assessment and collection of the municipal taxes, with which up to that time the assessor and collector of the city of Manila had been charged. On April 1, 1906, this bureau was charged with the enforcement of the opium law, act No. 1461, and with the assessment and collection of the taxes imposed therein, and also with the collection of the San Lazaro estate rentals, formerly collected by the director of lands.

However, our facilities for doing the regular internal-revenue work of this bureau, and also the additional work imposed on us, have also been increased during the last fiscal year, and especially through the more liberal allowance for expenditures provided by the Philippine Commission for the current fiscal year. During the month of March of this year the old bureau quarters were abandoned and the entire office force was more comfortably installed in the building formerly occupied by the assessor and collector of the city of Manila. Meanwhile this building, known as "La Hacienda" under the Spanish régime, had been thoroughly revamped and in part reconstructed, and the employees of what had formerly been the city assessor and collector's office were merged in the bureau of internal revenue and were given space in the same building. The entire lower floor of the north wing of the building, formerly dark, damp casemates, was reconstructed and converted into well-lighted and ventilated office quarters. The cashier and his entire force of tellers, stamp and cedula sellers, and tax collectors were installed in these new quarters, and the tax-paying public of Manila is now being attended to more promptly and more satisfactorily than was possible under the old arrangements in this building. The merging of the two office forces in one building has also resulted in a marked economy of effort and time in the elimination of all duplication of work and has already made it possible to drop about thirty clerks from the rolls. The saving to the city of Manila has been over ₱30,000 in the cost of assessing and collecting its taxes during the last fiscal year. Still further economies are contemplated. The office force of this bureau is composed almost entirely of Filipinos, the American clerks constituting but a very small minority. As the Filipinos demonstrate aptitude they are being promoted to more responsible positions. This will continue to be the policy of this office in future.

In the field work of assessing and collecting the various taxes, enforcing the various laws, and detecting and reporting cases of fraud and delinquencies there has also been a marked improvement during the fiscal year for which this report is made. Since the office of the executive secretary has taken over the management of the offices of the various provincial treasurers, there has been a decided improvement in the personnel of those offices, and many other changes for the better have been introduced within the last few months; harmony and cooperation on the part of provincial officials with this office in its endeavors to enforce the internal-revenue and other laws is now the rule, where a year ago it was the exception. The quality of the force of internal-revenue agents has also been improved through resignations, voluntary or by request, of a number of the undesirable or unadaptable incumbents. Under the authority of the increased appropriation for this bureau for the current fiscal year an additional number of agents will be appointed, and they are now being selected from a large list of applicants. Three speedy, light-draft naptha launches have lately been purchased and, after complete tests, are found to be satisfactory for the purpose for which they were intended—i. e., for patrolling the nipa swamps and detecting evasions of the law on the part of distillers and other would-be defrauders of the revenue. Two more of these launches will be ordered and detailed to this work.

The entire situation is now well in hand, and bona fide responsible taxpayers will soon have no cause to complain that the government does not afford them ample protection against competitors endeavoring to sell nontax-paid goods. The forecasts made from time to time during the last two years by this office have been more than verified. Our percentage cost for collection is as small as it is in most other parts of the world where similar conditions exist—smaller, in fact, than it is in most. The internal-revenue tax burden in these islands is now more evenly and more equitably distributed than it has been under any of the schemes of taxation obtaining in the past. The various additional duties which by statute have devolved on this bureau since its creation two years since have all been promptly assimilated. It is for these reasons that we look forward with confidence in our ability to properly discharge the additional duties which the Philippine Commission has recently seen fit to impose on this bureau in act No. 1519, establishing metric standards as the future system of weights and measures in these islands.

Respectfully submitted.

JOHN S. HORD,
Collector of Internal Revenue,
Ex-Officio Assessor and Collector for the City of Manila.

Hon. HENRY C. IDE,
Secretary of Finance and Justice, Manila, P. I.

APPENDIX A.

Statement of reported collections under act No. 1189, July, 1906.

Alcohol and tobacco products:		
Distilled spirits	₱118, 885. 49	
Fermented liquors	8, 850. 00	
Manufactured tobacco	7, 715. 97	
Cigars	14, 586. 44	
Cigarettes	192, 844. 64	
Matches—		
Domestic	13, 300. 00	
Imported	8, 360. 84	
		₱364, 543. 38
Licenses:		
Dealers in alcohol and tobacco products—		
Brewers		
Distillers	1, 798. 00	
Rectifiers	1, 740. 00	
Retail dealers in liquors	5, 309. 17	
Retail "vino" dealers	11, 508. 80	
Wholesale liquor dealers	8, 930. 00	
Retail dealers in fermented liquors	4, 350. 00	
Wholesale dealers in fermented liquors	1, 395. 00	
Dealers in manufactured tobacco	18, 291. 67	
Manufacturers of tobacco	305. 00	
Manufacturers of cigars and cigarettes	806. 00	
Peddlers of taxable articles	924. 00	
		55, 357. 64
Business—		
Merchants	175, 351. 89	
Manufacturers	15, 145. 93	
Common carriers	1, 627. 60	
		192, 125. 42
Occupations—		
Stockbrokers	460. 00	
Real estate brokers	2, 440. 00	
Custom-house brokers	500. 00	
Pawnbrokers	900. 00	
Proprietors of theaters, etc	19, 604. 20	
Proprietors of circuses, etc		
Proprietors of billiard rooms	1, 164. 18	
Lawyers, etc	7, 334. 00	
Photographers, etc	595. 00	
Veterinarians, etc	765. 00	
Owners of race tracks	810. 00	
		34, 572. 38
Mines and mining concessions	20. 29	
		20. 29
Banks and bankers	60, 885. 40	
		60, 885. 40
Insurance companies	323. 98	
		323. 98
Forest products	665. 26	
		665. 26
Documentary stamps	13, 365. 64	
		13, 365. 64
Cedulas	64, 329. 00	
		64, 329. 00
Miscellaneous	79. 68	
		79. 68
Total		786, 268. 07

APPENDIX B.

Statement of city of Manila taxes collected during July, 1906.

Land tax—		
1902	₱3.02	
1903	562.52	
1904	1,754.05	
1905	3,866.67	
1906	11,185.51	
		₱17,371.77
Matadero receipts		14,259.87
Market receipts		20,906.01
Licenses:		
Liquor	14,572.50	
Business	565.50	
Entertainment	90.00	
Peddlers'	1,170.50	
Vehicle	1,592.00	
Dog	121.99	
		18,112.49
Live stock registration	41.20	
Live stock transfers	12.00	
		53.20
Vehicle equipment		127.00
Rents, city property		1,287.31
Municipal court receipts		4,521.23
Pail system		4,870.42
Vault cleaning		12,940.00
Weights and measures		243.10
Building permits		1,301.34
Boiler inspections		238.00
Water rents		54,070.74
Bureau of health		1,532.30
Justice of peace fees		454.30
Sheriff's fees		1,177.87
City electrician		464.40
Pound receipts		319.30
Miscellaneous		847.01
Percentage tax, Manila Electric Railroad and Light Company		3,114.85
Sales of city land		423.14
Secretary of municipal board		19.50
Cementerio del Norte		1,452.50
Transportation of meat		761.04
Total		160,868.69

APPENDIX C.

Collections made during the month of July, 1906.

[Opium law (act No. 1461, Philippine Commission).]

Registration certificates	₱8, 760. 00
Wholesale dealers' licenses	6, 750. 60
Retail dealers' licenses	6, 301. 56
Importers of opium	5, 967. 49
Preparers and dealers	10, 751. 01
Wholesale dealers	47. 96
Retail dealers	174. 43
Total	38, 753. 05

Rentals collected during month of July, 1906 from San Lazaro estate (Executive Order No. 15, March 12, 1906), ₱4,303.

Résumé of collections made during the month of July, 1906.

Internal-revenue taxes	₱786, 268. 07
Municipal taxes, city of Manila	160, 868. 69
Opium taxes	38, 753. 05
San Lazaro estate rentals	4, 303. 00
Grand total	990, 192. 81

EXHIBIT No. 4.

REPORT OF THE MUNICIPAL BOARD OF THE CITY OF MANILA.

MUNICIPAL BOARD, CITY OF MANILA,
Manila, P. I., August 27, 1906.

SIR: In compliance with the provisions of the charter of the city of Manila, the municipal board hereby submits the fifth annual report of the operations of the government of the city for the fiscal year ending June 30, 1906.

Respectfully submitted.

FELIX M. ROXAS,
President.
For P. G. MCDONNELL,
MIGUEL VELASCO.
ROBT. G. DIECK,
A. W. HASTINGS,
Members.

The SECRETARY OF FINANCE AND JUSTICE,
Manila, P. I.

OFFICE OF THE SECRETARY.

There have been two changes in the personnel of the board. On September 18, 1905, Mr. Arsenio Cruz Herrera resigned the presidency, and on September 19 Mr. Felix M. Roxas, formerly judge of the court of customs appeals, was appointed to fill the vacancy. On November 4 Mr. C. H. Sleeper, having been appointed director of lands, resigned his position as a member of the board, and Mr. A. W. Hastings, formerly city assessor and collector, was appointed on November 14 to fill the vacancy.

By resolution of November 21 the board reduced its various committees from three members to one member, and in pursuance thereof the president named the following committees, which have remained unchanged:

Committee.	Member.	Committee.	Member.
Law	Roxas.	New sewer and waterworks systems.	Roxas.
Engineering and public works	McDonnell.	Health	Do.
Police	Do.	Advisory board	Velasco.
Education	Roxas.	Markets and matadero	Do.
Fire	McDonnell.	Expropriation of lands	Do.
Electrical installation and illumination.	Do.	Transportation and sanitation	Hastings.
Finance and taxation	Hastings.	Licenses	Do.

Two hundred and ninety-nine sessions of the board were held and 2,863 different items of municipal business considered and acted upon, of which 36 were referred to the advisory board for its consideration and advice. In addition to these, 49 other matters, mainly suggestions, recommendations, and complaints, were received from the advisory board and given due consideration. In addition to the large number of routine papers submitted for approval—such as requisitions for supplies and for printing, applications for licenses, etc.—7,371 letters were received and 8,764 formal letters sent.

The board executed 24 leases, entered into 31 contracts, and passed 9 ordinances. Proposed ordinances to the number of 6 are under consideration, but definite action thereon has not been taken.

Ordinances enacted by the municipal board during the fiscal year 1906.

No.	Object.	Date of enactment.
76	Amendment to No. 15, provost-marshal-general, regulating the sale of food and drink	Sept. 11, 1905
77	Closing places of public amusement not later than 12.30 midnight	Oct. 12, 1905
78	Building ordinance	Dec. 19, 1905
79	Amending No. 46, monthly reading of water meters by inspectors	Jan. 2, 1906
80	Amending No. 28, to prevent removal of landmarks, etc	Feb. 5, 1906
81	Regulating street railways and defining their obligations	Mar. 24, 1906
82	Amending No. 78, permit projections on streets of 8 meters	Mar. 30, 1906
83	Amending No. 42, relating to pawnbrokers	June 19, 1906
85	An ordinance relating to city water supply	June 30, 1906

PROPOSED ORDINANCES.

The following proposed ordinances are under consideration: Plumbing ordinance; regulating the use and repair of boilers, engines, and motors; amending No. 78, building code; regulating city water supply and service; sanitary code; licenses and permits.

On August 17 the contract between the city and the San Juan de Dios Hospital for the care and treatment of the indigent sick was divided, and now, instead of the city maintaining 100 beds at the San Juan de Dios Hospital, as formerly, but 50 are maintained there, and another 50 maintained at St. Paul's Hospital. Under these two contracts the indigent sick of the city are cared for at a cost to the city or ₱1.40 per day for each patient.

A contract was entered into April 27 with the Hospicio de San José, under which juvenile offenders sentenced by the municipal court and by the courts of first instance are cared for, fed, clothed, and instructed to their physical, mental, and moral betterment, at a cost to the city of ₱0.40 each per day. A department of this institution is operated as a reform school, thus supplying a very much needed municipal want. Lists of those sent to the hospitals and to the reform school, showing in detail the cost to the city and giving other statistical information respecting city patients and youthful wrongdoers, are submitted.[a]

Minors sent to San Jose: First case sent February 13, 1906; sent in February, 10; March, 14; April, 9; May, 12; June, 9—a total of 54, at a total cost of ₱1,476.80. Number of males, 49; females, 5; total, 54. Average age, 13 years 4 months.

There having been no one office charged particularly with the duty of keeping the records of the large, varied, and scattered real properties of the city, the secretary of the board was directed, by resolution of June 27, to prepare a list of all real estate of the city with all data available, and submit the same to the board. This work has been completed, and there is now in the office a book showing complete statements of all city properties, with their respective assessed valuations and the uses to which they are being put, together with a plan of each piece of property, giving the dimensions, area, and assessed valuation. The book, like all the other records of the office, is open to the public.

The assessed valuation of the real estate owned by the city is shown to be

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[a] Statement of indigent sick, number, and cost is on file in the War Department.

₱7,412,875.16, and the uses to which it is being put and the municipal district in which it lies are shown by the following table:

Assessed valuation of city property.

School department	₱161,093.33
Fire department	217,429.22
Police department	46,773.92
Sanitation and transportation, including city stables, crematories, etc.	288,034.13
Parks	3,377,699.40
Markets and matadero	1,113,472.15
Engineering department and city shops	160,723.25
For administrative purposes (city hall)	154,246.00
By municipal cemeteries	305,706.11
Insular government	860,100.98
United States Army	95,418.00
Rented	116,620.84
Unoccupied	515,557.83
Total value of real property belonging to the city	7,412,875.16

DISBURSING OFFICE.

The disbursing officer, Mr. R. C. Baldwin, has effected many changes in the system of paying city employees within the past year, and all "for the good of the service."

It was no unusual sight to see hundreds of city laborers standing about the city hall on pay days, many of them accompanied by wife and children, waiting to receive their monthly wages. Now very few are seen there for that purpose, and why? Because the disbursing officer, with his assistant, goes into all parts of the city with his pay rolls and money bags and pays the laborer at his place of work.

The result is much saving of time and expense to the city and to the individual and his family.

The disbursements for the fiscal year 1906 exceeded those of any previous year, aggregating ₱5,843,554.24. Of the above amount ₱1,634,728.14 was for permanent public improvements and the sum of ₱233,335.98 represents inter-department transactions; that is, the earnings of one department of the city for the benefit and at the expense of some other department, such as transportation service and work done at the city shops. The actual ordinary or current expenses of the city cover the balance of the sum disbursed and amount to ₱3,975,490.12.[a]

Comparative statement of disbursements by fiscal years since inauguration of the municipal government on August 7, 1901.

Department.	August 7, 1901, to June 30, 1902.	Fiscal year—			
		1903.	1904.	1905.	1906.
Municipal board, advisory board, disbursing office, and public charities	₱124,188.04	₱224,701.62	₱224,460.87	₱220,503.24	₱204,671.00
Law	113,108.48	139,436.12	147,765.93	142,795.13	150,783.59
Fire	103,554.08	354,698.34	341,428.68	318,416.82	294,809.63
Engineering	1,412,707.40	1,741,118.37	2,517,881.94	1,979,299.35	1,100,693.99
Sanitation and transportation					907,147.61
Sewer and waterworks construction				5,743.28	592,097.48
Assessments and collections	189,028.46	161,053.94	171.756.30	168,014.46	115,899.24
Police	1,118,182.48	1,250,952.09	1,213,584.91	1,204,894.22	1,155,929.37
City schools	142,539.24	167,142.83	279,746.25	297,875.28	272,512.42
Public works			378,562.65	705,733.02	782,610.58
Luneta extension					260,020.08
Total	3,203,308.18	4,039,103.31	5,275,187.53	5,043,274.80	5,837,174.99

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[a] The following statements submitted by the disbursing officer are on file in the War Department: Recapitulation of expenditures from appropriations; Summary of all expenditures; Monthly salary payments; Daily wage payments; Expenditures for the care of city prisoners confined in Bilibid prison.

FINANCE.

Prior to the fiscal year 1905 the annual revenues of the city were sufficient to not only meet its share of the current expenses and provide liberally for public improvements, but were also sufficiently large to show at the end of each year a substantial balance to carry forward to the next year, as shown by the following condensed statement of receipts and expenditures:

Condensed statement of collections, disbursements, and balances for the fiscal years 1902, 1903, 1904, and 1905.

Year.	Debit.	Amount.	Year.	Credit.	Amount.
		U. S. currency.			*U. S. currency.*
1902	Disbursements	$1,526,485.15	1902	Collections	$1,116,591.79
	Balance June 30, 1902	48,052.19		Insular government, 30 per cent of withdrawals	457,945.55
		1,574,537.34			1,574,537.34
1903	Disbursements	1,962,078.00	1903	Balance on hand July 1, 1902	48,052.19
	Balance June 30, 1903	204,937.52		Collections for fiscal year 1903	1,530,554.78
				Insular government, 30 per cent on $1,961,361.83	588,408.55
		2,167,015.52			2,167,015.52
		Phil. currency.			*Phil. currency.*
1904	Disbursements	₱5,292,772.42	1904	Balance on hand July 1, 1903	₱409,875.04
	Balance June 30, 1904	608,710.93		Collections for fiscal year 1904	3,905,133.42
				Insular government, 30 per cent on ₱5,288,249.62	1,586,474.89
		5,901,483.35			5,901,483.35
[a]1905	Disbursements	5,129,490.76	1905	Balance on hand July 1, 1904	608,710.93
				Collections for fiscal year 1905	2,890,674.55
				Insular government, 30 per cent on ₱5,093,728.50	1,528,118.55
				Reimbursement by bureau of internal revenue	29,150.00
				Balance (deficit)	72,836.73
	Total	5,129,490.76		Total	5,129,490.76

[a] To balance due government July 1, 1905, ₱72,836.73.

From the foregoing statement it will be observed that the expenditures for 1905 exceeded the current revenues and government contribution by ₱681,547.66 and left a deficit of ₱72,836.73 to be brought forward in place of the usual substantial credit balance. So it may with reason be said that the year 1906 marked the beginning of a new condition of affairs from a financial standpoint. That is to say, the real effect of the new internal-revenue law reducing the revenues of the city ₱900,000 or more is for the first time fully realized. The estimate of revenues for 1906, based upon a 2 per cent tax levy on real estate for the calendar years 1905 and 1906, was less by nearly ₱200,000 than for 1905 and ₱960,000 less than for 1904, with large public improvements under way that must be carried on to completion.

In the face of these conditions, the board reduced the estimates covering ordinary expenses by nearly ₱200,000, as compared with the amount expended the previous year, and was prepared for a still further reduction by the Commission. Consideration by the Commission of the budget for 1906 was unavoidably delayed waiting the outcome of the report of the reorganization committee of the insular government, and it was not until December 15 that the city appropriation was determined. From July 1 to December 15 (nearly six months) expenditures continued on the basis of the appropriation for 1905.

The estimate as presented to the Commission called for a total appropriation of ₱5,341,000, not including sewer and waterworks construction, and anticipated an overdraft for the year of ₱242,611. This reduction was based upon estimated collections, ₱3,146,500, transfer from sewer and waterworks construction account, ₱359,889, and the usual 30 per cent contributions from the insular government, estimated at ₱1,592,000.

The tax upon real estate is levied by the calendar year and is payable in two installments, the first on or before June 30 and the second on or before December 31. Therefore, in calculating the revenues for a given fiscal year a part of two calendar years' taxes must be considered in estimating the receipts from this source.

As before stated, the estimate of collections was based upon a 2 per cent real estate tax levy for 1905 and 1906, but the Commission, before taking up for consideration the expense budget, reduced, by act No. 1420, the tax levy for the calendar year 1905 to 1½ per cent; and this in the last month of the year in which the tax was due. The prospective revenues were thereby reduced ₱387,702 and the calculations of the board seriously affected. Other items amounting to ₱102,000 were also stricken from the estimate. The expense estimates were scaled in like proportion, with the result that act No. 1421 appropriated the sum of ₱4,569,683, anticipating about the same deficit as did the original estimate.

That the actual deficit, as shown on balance sheet given below, is so much larger than was contemplated is almost wholly attributable to the following three causes:

(1) The debit balance at the beginning of the year was larger by nearly ₱50,000 than was first made to appear.

(2) The collections fell short of the amount estimated by ₱176,000.

(3) Extra allowances:

For new bridge	₱8,972
For street widening, etc	31,757
For public works, act No. 1222	12,782
For Cuartel Meisic	18,000
Total extra for public works	71,511
Extra allowance to cover deficiency in law and police departments	69,236

Balance sheet June 30, 1906 (fiscal year 1906.)

Debit.	Amount.	Credit.	Amount.
Balance due government July 1, 1905	₱72,836.73	Collections: By city assessor and collector	₱2,465,780.40
		By register of deeds	14,850.11
Disbursements account fiscal year 1905	6,379.25	By disbursing officer	233,335.98
Disbursements account fiscal year 1906	5,245,077.51	By department of sanitation and transportation for transportation furnished insular government	114,796.73
Transportation furnished insular government to apply on purchase of corral equipment	114,796.73	Sewer and waterworks construction account of transfer under act No. 1422, 70 per cent of ₱358,322.47	250,825.73
		Insular government, loan account of Luneta extension, 70 per cent of ₱260,020.08	182,014.05
		Insular government, 30 per cent of ₱5,098,927.22	1,529,678.17
		Secretary municipal board, forfeit by San Nicolas Iron Works of deposit on contract	60.00
		Balance	647,749.05
Total	[a] 5,439,090.22	Total	5,439,090.22

[a] To balance brought down, ₱647,749.05.

NOTE.—Sewer and waterworks construction account not included in the above.

The sum total disbursed during the fiscal year 1906, as appears in the foregoing statement, is	₱5, 251, 456. 76
Deduct departmental transfers	233, 335. 98
Leaves the net expenditures	5, 018, 120. 78
Classified as follows:	
Permanent public improvements	1, 042, 630. 66
Current expenses	3, 975, 490. 12
Total	5, 018, 120. 78

Had the appropriation been made earlier in the year it is believed a much more favorable showing could now be made. The economies that otherwise would have extended over the whole year were necessarily restricted to the half year following the date of the appropriation.

Sewer and waterworks account.

Proceeds of sale of $1,000,000 gold bonds of the issue of June 1, 1905, at $1.095625, in Philippine currency		₱2, 191, 250. 00
Expended fiscal year—		
1905	₱5, 743. 28	
1906	592, 097. 48	
Total expended to June 30, 1906		597, 840. 76
Balance on hand June 30, 1906		1, 593, 409. 24

A large share of this fund has been kept on deposit in New York at 4 per cent interest.

Act No. 1323 of the Philippine Commission authorized the issue by the city of Manila of $4,000,000 of thirty-year 4 per cent nontaxable gold bonds for the purpose of constructing sewers and furnishing the city with an adequate supply of water; $1,000,000 of said bonds, as shown in the above statement, have already been issued and sold at a handsome premium, $2,000,000 will be issued January 2, 1907, and the balance January 2, 1908, as provided by said act No. 1323.

Real estate belonging to the city of Manila June 30, 1906, listed by districts.

Intramuros	₱1, 364, 173	Ermita	₱1, 497, 446
Binondo	361, 578	Malate	224, 426
San Nicolas	869, 424	Paco	209, 495
Santa Cruz	434, 146	Pandacan	7, 443
Quiapo	100, 033	Santa Ana	536
San Miguel	12, 569		
Sampaloc	155, 368	Total	5, 566, 957
Tondo	330, 320		

Nonexpendable personal property belonging to the city of Manila June 30, 1906, as invoiced and reported by the chiefs of departments.

Municipal board	₱9, 139. 65	Schools	₱108, 037. 60
Disbursing officer of municipal board	4, 298. 42	Law department	29, 212. 28
Engineering and public works	463, 272. 78	Sanitation and transportation	529, 245. 08
Police	182, 128. 78	Total	1, 688, 202. 53
Fire	356, 026. 54		
Assessment and collections	6, 841. 40		

Assets of the city of Manila.

Real estate, as per above statement	₱5, 566, 957. 00
Personal property	1, 688, 202. 53
Accrued interest on money deposited in New York, estimated at	50, 000. 00
Internal-revenue dividend for first quarter of 1906, estimated at	47, 000. 00
Insular government for police service not yet adjusted	277, 550. 00
Internal-revenue department for refunds to distillers erroneously charged city	986. 01
Claim against San Lazaro estate for taxes against its land from 1901 to 1906, inclusive, estimated at	200, 000. 00
93 shares of the capital stock Banco Español-Filipino, at ₱300 per share (market value)	28, 200. 00
Total	7, 858, 895. 54

NOTE.—Assessed valuation of real estate subject to taxation within the city of Manila, ₱80,525,235.

Liabilities of the city of Manila June 30, 1906.

Water and sewer bonds issue of June 1, 1905, under act No. 1323	₱2, 000, 000. 00
Balance due insular government on account of purchase of transportation equipment and corral	106, 569. 24
Due insular government on account of Luneta extension	182, 014. 05
Due insular government on general account	647, 749. 05
Total	2, 936, 332. 34
70 per cent of unexpended balances of appropriations fiscal year 1906 and previous years (contingent)	193, 951. 44

ESTIMATES, ETC., FISCAL YEAR 1907.

The estimated current or ordinary expenses for the ensuing year, as per estimates already in the hands of the honorable Commission, totalize in round figures	₱3, 500, 000
To this amount should be added to provide for sinking fund and interest on bonds, already appropriated	158, 740
Also, first annual payment on Luneta extension	35, 000
Total	3, 693, 740

A sum well within what we believe to be a conservative estimate of the city's revenues for the coming year, including, of course, the 30 per cent contribution by the insular government and less for current expenses by ₱475,000 than was appropriated last year for the same.

We believe that the revenues will also provide for a substantial reduction of the present deficit, with expenses on above basis.

It will be observed that the above estimate makes no provision for permanent public improvements, a fact that is much to be regretted. That public works that inure to the permanent benefit of the city should go on, we are in hearty accord. The city must not stand still in this respect. Public improvements necessary to making Manila an up-to-date and attractive city should go steadily but conservatively forward, and it is our judgment that the city's revenues can be consistently increased so that a reasonable provision may be made each year for this purpose. To that end the board makes the following suggestions, to wit:

The assessed valuation of real estate within the city of Manila is ₱80,525,000. The annual tax rate fixed by act No. 183 is 20 mills; the rate thus far imposed has not exceeded 15 mills; a tax of 1 mill produces ₱80,525. The estimate of revenues for 1907 is based upon a 15-mills levy; increase this to 17 mills and the revenues would be augmented ₱161,000.

The cedula tax is uniform throughout the islands, while in the larger cities, especially in Manila, the taxpayer enjoys benefits which do not extend to those living in the provinces. A very large majority pay no other tax, and it appears to us no more than right and just that a larger contribution should be made toward paying the many expenses incident to the maintenance of a large city.

The increase of this tax to ₱2, which we recommend, would yield approximately an additional ₱50,000.

Increasing the fee for the registration of live stock, as already recommended by the board, would probably yield, say, ₱20,000.

The proposed new license ordinance is estimated to produce at least ₱75,000.

Sixty per cent or more of the internal-revenue tax is collected within the city of Manila.

Under the present law the city of Manila receives less than 1 per cent of the total collection throughout the archipelago, not including the cedula tax collected wholly for the benefit of the city. A dividend of at least 5 per cent would be, in our judgment, a more equitable division and would give to the city an additional ₱250,000 or ₱300,000.

It would not be an unreasonable measure to impose a light wharfage tax that would help out in the maintenance of river walls, walling in and deepening of esteros, etc., as provided by the charter.

In connection with the subject of public improvements, it may be said that the board has, upon the suggestion of taxpayers, informally considered the advisability of asking for authority for a further issue of improvement bonds, and such a plan was recommended in the last annual report.

It is believed now, however, that it would be a mistake for the city to go more deeply into debt. While it sounds very well in theory to let coming generations pay their share of the benefits to be enjoyed by them, and in practice is logical as applied to such improvements as the present bond issue covers, coming generations will have plenty of ways for their money to keep the good work going along; for a city is never finished unless by the apathy of its own citizens it becomes literally dead, and in such a condition the burden of a bonded debt would be greater to them than the paying-as-we-go-along plan is to the taxpayers of to-day.

The bonded debt already created is equal to 10 per cent of the total taxable property of Manila, and this ratio of indebtedness would be considered the limit in any well-governed city in the States.

When all the bonds now authorized are issued and disposed of, the fixed charges for interest and for the sinking fund will aggregate ₱475,000 annually—no insignificant sum to be provided for out of the much-limited resources of the city.

It is therefore the judgment of the board that the bonded debt should not be further increased until such time at least when the sinking fund shall have reached such proportions as to materially reduce the present bonded debt.

Estimate of current expenses for fiscal year 1907 as submitted to the Commission.

Municipal board		₱208,200.00
Law department		128,222.00
Fire department		292,679.74
Police department		840,875.00
Schools		292,694.00
Department of sanitation and transportation		737,300.00
Department of engineering		891,674.00
Department of assessments and collections		107,500.00
Total		3,499,144.74
Add for interest on bonds and sinking fund		158,740.00
Add for first payment "Luneta extension" loan		35,000.00
Grand total		3,692,884.74
Estimated revenues, as per latest report of city assessor and collector, based upon a real-estate levy of 1½ per cent	₱2,719,300.00	
Deduct, say	19,300.00	
Total	2,700,000.00	
Add insular government's share	1,157,142.85	
Grand total	3,857,142,85	
Surplus to apply to deficit on public works		164,258.11
Aggregate		3,857,142.85

ENGINEERING AND PUBLIC WORKS.

Following is the report of the work accomplished by the department of engineering and public works for the year ending June 30, 1906:

From July 1, 1905, to August 14, the office was in charge of Mr. Howard F. Hyde, first assistant engineer, as acting city engineer, and since that date under charge of Mr. Robert G. Dieck, as acting city engineer to December 31, 1905, and as city engineer since January 1. The department is organized under the following divisions: (1) Drafting and surveys, with Mr. W. P. Wylie, first assistant city engineer, in charge; (2) water supply and sewers, Mr. A. F. Armstrong, superintendent (on leave), and Mr. A. Gideon, assistant engineer, sewer and waterworks, acting superintendent; (3) street construction and bridges, Mr. L. F. Patstone, superintendent in charge; (4) buildings and plumbing inspection, Mr. L. A. Dorrington, superintendent (on leave), and Mr. Claude Lindsey, chief clerk, acting superintendent; (5) the city repair shops, Mr. H. J. Meany, superintendent in charge.

DRAFTING AND SURVEYS.

The main body of work accomplished by this office has been the establishment of street lines and grades, and the lines for general construction throughout the city, the preparation of plans and technical descriptions of land expropriated for street widening, and the checking of descriptions of properties entered for registration before the court of land registration. Careful attention is required in all these branches of the work, for in them the interests of the city are directly affected.

Considerable difficulty has been encountered throughout the whole year in checking descriptions of property sought to be registered as submitted by private surveyors. There seems to be small appreciation of the fact that there is variation in the magnetic north, and that reference to the city lines should be made in the descriptions. A large majority of the descriptions submitted are so palpably in error that their acceptance by the court of land registration must eventually produce difficulties in the transfer of lands. Cases have been noted in which an error of 25 per cent in area appear. With the extension of the city monuments a large percentage of this difficulty will be removed, as immediate reference to the city lines can then be made by private surveyors. With this end in view, a number of monuments have been set in the city in accordance with the lines established by the municipal board, but a large part of this work remains untouched. Appreciating the fact that the fixed points on streets are in danger of being lost through removals and new construction, efforts are being put forth to preserve all such points by establishing monuments as rapidly as possible. This work will be pushed in the coming year.

The following-named streets were surveyed and building lines approved: Calles Gagalangin, Union, Moriones (east from Calle Lemery to Calle Santa Monica), Tondo; Calles Amador Ariadan, Caballeros, and Juan de Moriones, San Nicolas; Calle Orozco, Santa Cruz; an unnamed street extending northward from the Ayala Bridge to Alejandro Farnecio with a connection to Calle Tanduay, San Miguel; Paseo Magallanes, Intramuros; San Antonio (F street) and Callejon Grey, Ermita; Calles Looban, Perdigon, Peñafrancia and Union, Paco; and Calle A and First and Second avenues in the Santa Ana street scheme.

General maps of the districts of Binondo, Santa Cruz, and Quiapo, on a scale of 1 to 400, connecting the approved street lines, have been prepared. A complete topographical survey has been made of the district of Intramuros, between Calzada de Bagumbayan and Fort Santiago, including the new harbor works, the Luneta extension, and the new harbor lines for the Pasig River. When completed, the plan prepared from the notes of the survey will form a rational basis for the location of streets in the reclaimed area and for the treatment of the city wall and the moats.

The system of city levels was extended by the location of 272 benches referred to mean lower low water as determined by the United States Coast and Geodetic Survey. Many of the monuments previously established had been destroyed through changes in street grades and construction of new buildings, and all were replaced. In all, there exists 375 checked benches in the city, which is a sufficiently extended system for present purposes.

A number of observations were made upon the polar star for the determination of true north and the true bearing of streets determined therefrom. The data secured from these observations will be of great value to private surveyors, as the lines of their surveys may be referred directly to the true north instead of as at present to a magnetic north, which varies considerably in different parts of the city.

The development of the plan for the Cementerio del Norte was carried out as the needs demanded, the lines of the roads and lots being carefully marked by monuments. Probably only minor work will be required during the coming year, as lots in the cemetery are not now being acquired very rapidly.

The cement-testing laboratory was operated with satisfaction during the year, and several shipments of cement intended for use on public works were rejected for failure to comply with the specifications. The equipment of the laboratory is rather restricted, and complete physical tests may not be made. However, in general, the tests have indicated with reasonable accuracy the character and physical qualities of the cement submitted. Although more complete tests are desirable to thoroughly determine the quality of cements for special purposes, these may at present be omitted, but eventually the laboratory should be fully equipped in order that full knowledge of all cements supplied in the local market may be obtained.

The wall constructed from insular funds, under contract with Mr. Salvador Farrê, west from a point near the old Santo Domingo gate for a distance of approximately 304 meters, was completed on March 26, 1906, for a total cost of ₱314,935.80. The original estimate of cost was ₱306,856, the increase in cost being due to minor changes found necessary in the work and to the increase in length and number of piles in certain doubtful sections of the work. The back filling behind the wall has been carried on with the funds remaining available from the appropriation, and to June 30 ₱10,014.22 were expended in this work. It is recommended that the work be protected on the stream face by riprap, as dredging in the river to the depth of 18 feet, as determined by the bureau of port works, may eventually create dangerous currents at the foot of the wall. A slight movement has already been observed in a portion of the work and may be traced to this cause.

The Atlantic, Gulf and Pacific Company secured the contract for the construction of the concrete river walls immediately west of the Bridge of Spain and commenced work in July. On the north side of the river a wall of approximately 95 meters' length was completed by the caisson method from the north abutment of the Bridge of Spain to the west side of Calle Rosario at a cost of ₱111,255.86. In connection with this work, the west approach to the bridge was widened and a Guadalupe stone wall constructed in the rear of the Extremeña building from the general funds of the department. The grade of the approach was decreased from about 9 to 4.5 per cent and its length increased from 30 to 55 meters. The substratum of soil near the bridge showed less bearing power than anticipated, and extra long piles were necessary to insure safety. Because of the shallow foundations of the north abutment of the bridge a change in plan at this point was necessary and a special construction employed immediately adjoining the abutment. Signs of weakness appeared in the masonry of the abutment, and in order to avoid any accident heavy piles were driven as close to the bridge abutments as possible and concrete deposited in large bulk immediately alongside of the abutment. As a further protection to the wall a close connection between the abutment and the wall was avoided, and for a short distance immediately alongside of the bridge the wall was constructed as a screen without a caisson. This method of treatment has been very successful, and careful observation has failed to discover any weakness either in the wall or in the abutment. As a further protection to the work especially heavy riprap was deposited at this point.

The work on the south wall was commenced from the east end of the Farrê wall and carried on continuously from this point. Up to June 30 ten caissons of the twelve to be sunk were in place and completed. The total estimated value of the work on that date was ₱130,508.16. It was anticipated that 244 linear meters of wall could be constructed on this bank with the funds available, but as a result of the experience gained on the north river wall in the matter of piles, which were of greater length than estimated, instructions were given to the contractors to prepare for the construction of 180 meters of wall only. Later developments in the work showed that the length of piling would not be as great as that on the north wall and that about 220 meters of wall could be constructed with the funds available. It is hoped that the contractors will continue their work under the present contract, although it is probable that an agreement of this nature may not be secured, because their preparations had been made in accordance with the previous intructions. In general, in regard to these walls, it is believed that the crib foundation is of unnecessarily great thickness and economy in this direction could be secured. When the wall is extended to the Bridge of Spain a change in this portion of the plan is desirable for economical reasons. During the construction the type of coping was changed from granite to concrete, and the appearance of this coping is uniformly good. The only difficulty is that injury to it may occur while the concrete is green.

WATER SUPPLY AND SEWERS.

The equipment of the pumping station shows signs of wear. The steady increase in the use of water consequent upon a more extended sprinkling of streets and the installation of sanitary fixtures in a large number of buildings has so far taxed the pumps that they are badly worn in all the moving parts. In consequence of this severe service minor defects can not be noticed, as opportunity to shut down the pumps for an inspection rarely occurs. At the end of the past dry season an examination showed that extensive repairs were necessary. This neglect, consequent upon the continued operation of the pumps, has increased the coal consumption, and efforts will be made in the coming year to correct all imperfections in the pumps, so that the consumption of coal may be reduced to the minimum.

Three accidents to the boiler equipment occurred. The furnaces of boilers A, B, and C were burned at points close to the feed connection. The total cost for the repairs to these boilers was ₱6,145.

All the buildings at the pumping station and deposito are in good condition, having been painted and repaired during the year. The rock-fill dam on the Mariquina River has been repaired in part and the concrete paving on the crest at the east end which was uncompleted at the commencement of the last rainy season was finished. The dam is now reasonably tight and supplies sufficient water for the pumps.

The conduit and reservoirs are badly in need of overhauling. During the past dry season, when there was for about a month a considerable shortage of water, a cursory examination was made of the conduit and reservoir, and several large leaks were located. As permanent springs are seen close to these structures there is reason to believe that other leaks of magnitude exist. These, however, may not be definitely located without emptying the conduit and reservoir. Their existence is also proven by the extensive filtration into the conduit and reservoir during times of heavy rain, when the engines may be stopped without reducing the supply to the city or lowering the water level in the reservoir. Further than this, the conduit is badly fouled, and the resistance to flow is increased by large deposits of silt on the floor and growths on the walls. in all probability the fishy taste of the water may be lessened by the removal of all these plants from the conduit.

Repairs to the Santolan road were of a minor nature and only such as would keep up communication between the city and the station. The operation of the road locomotive through the year has not been satisfactory, as a sufficiently hard road service could not be secured. The heavy dust along the road has also injured the moving parts of the engine and made considerable repairs necessary.

The distribution system is in good condition in all its parts, although a number of minor repairs have been necessary. The uncovered 26 and 22 inch mains from a point east of Calle Tanduay to Calle Arlegui were lowered and covered and the bridge crossing the line at Calle Tanduay removed. This job was of a rather difficult nature, in view of the fact that a stiff connection with three large-flanged valves was located in the bed of Calle Tanduay and was necessarily moved as one piece. The total lowering at this point was about 1.50 meters and was accomplished without mishap or interruption of the supply. The total cost of the work was ₱2,069.29.

In consequence of the removal of the old Ayala bridge the 12-inch main supply for Malate was shifted from the old bridge to the bridge in course of erection. While operating on this transfer a launch with a heavy tow collided with the screw-pile foundation of the old bridge, wrecking the trusses and breaking the water pipe. Preparations for the transfer were so far advanced that the shifting of the pipe was completed within twenty-seven hours and water turned on.

During the year 11 pipe extensions were laid with funds secured from the bond issue. The necessity for further extending the distribution system by lines of small diameter into the outlying districts is very apparent. Extension must closely follow improvements to property in order that taxpayers may be supplied at the earliest practicable moment.

The fire-hydrant service has been increased during the year by 18 fire hydrants of the new pattern, and has been constantly in good working order. The fire department has been of great assistance in locating imperfections in the system by its monthly inspections and tests.

The installations of services had a substantial increase during the year. In all, 395 services were connected—an increase of 11 per cent in the total number of services. This increase may be traced in part to the extensive building operations and to the requirements of the bureau of health.

The ordinance now in force regulating the water supply has been found insufficient and in some points obscure. As a consequence, its enforcement has been both difficult and open to criticism. A simplified and more complete ordinance has been drafted and is now before the board. All the points on which there was contention have been touched upon in this draft, and it is hoped that upon passage of the ordinance no further complaint will be possible. The present water rate, while yielding sufficient revenue to meet the ordinary expenses of operation, is too low. Considering all factors entering into the production of water—the difficulty of coal haulage, the continual repairs to the conduit, reservoirs, pumping machinery, and boilers, the supply of large quantities of water for government uses, and the expense of extending the water mains—the charge of 5 centavos per cubic meter or 20 centavos per 1,000 gallons is very reasonable. The present method of computing charges is rather complicated, in that for larger quantities of water than 300 cubic meters per month the excess over 300 cubic meters is charged at 4 cents per cubic meter. The smaller consumers will not be affected by this proposed change of rate. The charge of 10 cents per cubic meter for water delivered to water boats is also too low, and a considerable increase of revenue may be secured by increasing this charge. Heretofore no provision has been made for a sinking fund to provide for extensions and the replacement of worn-out machinery. The establishment of such a fund is recommended, in order that a reserve may be available at all times for work of this nature.

A general survey was made of the existing sewers within the city in order to determine their location, size, and depth with reference to the city lines and benches. A large number of unknown sewers was discovered, and the data secured will be of extreme value in the sewer and water construction now under way. This survey has revealed the fact that a large amount of unnecessary work has been performed which eventually must be abandoned. The sewers constructed in the past two years on a definite plan have shown themselves to be capable of removing the water from the streets, even in the heaviest showers, and of keeping themselves clear of sediment. There are certain localities, however, which are badly in need of drainage facilities, particularly parts of Paco, Ermita, and Tondo, where changes in grade and the construction of new streets have interfered with the natural drainage. All new work constructed during the year was from funds arising from the bond issue, and was laid out in conformity with the general drainage scheme.

The entire drainage system of Intramuros was examined and cleaned, as were the drainage systems of parts of Binondo and Quiapo. The work required in Itramuros clearly showed that these sewers had been neglected entirely for many years. In all, 2,000 cubic meters of material were removed from the sewers. This deposit consisted in most part of sand and stone from street washings, mixed with putrefying vegetable matter. Silt basins, while serving to prevent the entry of street washings, are useless unless thoroughly and regularly cleaned, so that their construction in inlets, except in particular instances, is inadvisable, as in this climate they would cause nuisances.

The temporary sewers in the moat were cleaned and repaired where necessary. Careful investigation of their condition shows that they can not much longer remain without extensive repairs. It is essential that permanent drains be constructed in their place within a short time, as with each year the item of repairs and renewals will become heavier.

The section of boiler inspection, under charge of the boiler inspector, made 186 inspections of boilers of an aggregate of 8,546 horsepower. As the time of the boiler inspector was not entirely consumed in the regular inspections, his services were employed in conducting inspections of city machinery and of repairs to equipment.

By the repeal of the old building ordinance, the regulations under which the inspection of boilers was carried out were likewise repealed, and an entirely new ordinance, separate in all respects from the building ordinance, must be enacted. A draft for such an ordinance is now before the Board and should receive its early consideration. It is essential that the practice of steam engineering should be regulated by requiring candidates to submit to an examination before a board of competent persons. At present, many incompetent persons are employed in the operation of machinery and the care of boilers, and that serious accidents have not occurred is remarkable. An examination of the boilers in the city makes it clear that it has been the practice of importers to offer for sale in the Manila market boilers whose installation in places with rigid ordinances would not be permitted. A modern ordinance drawn in conformity with the latest practice would prevent such installations. Even though many boilers are deficient in design, their owners insist that high pressures be allowed, and much friction has been caused thereby. It is very important that a complete ordinance governing all boilers and machinery be enacted at an early date.

STREET CONSTRUCTION AND BRIDGES.

The organization of this office has remained practically constant, the street work being divided into four districts, each with an inspector—the bridge work under a bridge inspector, the water transportation under a launch master, and the quarry work under a foreman.

The street area under repair is as follows:

	Square meters.
Wood block	17,432
Granite block	37,679
Macadam	1,299,014
Total	1,354,125

This area includes 465 streets and 175 plazas and extends over 136.11 kilometers.

In the bridge section 54 bridges and 17 culverts are under repair. Under this section also the operation of the Binondo lift bridge falls and the construction of all heavy masonry walls.

The cost of operating the office for the supply of material was as follows:

Where used.	Labor.	Coal.	Dynamite.	Oil, waste, and minor supplies and repairs.	Total.
Quarry	₱42,867.10	₱6,833.97	₱5,943.66	₱5,934.87	₱61,579.60
Launches	10,929.84	8,513.50		7,458.95	26,902.29
Scows	46,301.10			8,733.42	55,034.52
Total					143,516.41

The cost of broken stone produced at the quarry under these items has been: Quarry, stone crushed, 49,954.03 cubic meters, unit cost, ₱1.33 per cubic meter (in the bins); launches, materials towed, 54,657.60 cubic meters, at ₱0.47 per cubic meter (includes gravel towed); scows, materials handled, 54,567.60 cubic meters, at ₱0.86 per cubic meter (including gravel handled).

Total cost of stone on shore, Manila, including wear and tear on plant, ₱2.56 per cubic meter.

The total cost of transportation for street work was ₱64,255.39. The success of street work depends in large measure upon the handling of the transportation, and the extent of the work accomplished is evidence of the fact that the transportation was used to good advantage. Observation made during the past year has shown that the stock traveling at the rate of 2 miles per hour can haul economically and without deterioration 3,800 pounds of material in double teams with American animals and 1,700 pounds in single teams with Chinese animals. The present equipment of rock beds and escort wagons is not suited to street work, as a large amount of unnecessary labor is expended in unloading, from the peculiar construction of the wagons. Experiments were tried with two 2-horse dumping wagons built at the shops. Their use has been very successful, and it is recommended that for work on streets wagons of similar nature only be employed. If this be done, a probable saving in labor to the amount of 5 or 10 per cent may be effected. The wagons have cost somewhat more than rock beds, but their use has proven economical in labor.

The launches made round trips to quarry as follows: *Washington*, 151 trips; distance traveled, 8,154 miles; *Jan.* 145 trips; distance traveled, 7,830 miles.

In addition, shorter trips were made to the gravel dredge in the upper Pasig River. These launches have been overhauled and repaired in the year, but the *Washington* is in such condition that its use for a longer period than six months is positively dangerous. The hull, including frames and sheathing, is in a rotten condition and may at any time fall out. A cement dam has been laid over the whole bottom in order to prolong the launch's usefulness, but this will probably not last for more than a few months. The placing of this cement has increased the draft and has made operation in the shallow river much more difficult. For this service a twin-screwed launch of draft not greater than 4 feet 6 inches is recommended as most efficient.

The scow equipment consists of 21 scows of 22 cubic meters capacity and 3 of 60 cubic meters capacity. The former are too small for economical work and the latter are too large for handling in the river. For this work scows of 30 to 40 cubic meters capacity, of light draft, are more suitable, and the replacement of the scows should be made on this basis. Several of the smaller scows are in bad condition and their use must shortly be discontinued.

The sidewalks throughout the city have been neglected. The order of the municipal board restraining the city engineer from ordering the construction and repair of walks in front of private property has worked to disadvantage and has resulted in entire neglect both by the city and by property owners. It is reasonable that the cost of such work should be a charge against abutting owners, and legislation in this sense should be secured. Considerable complaint has been made that the city in changing grades of streets has damaged sidewalks by laying them at their original elevation. This is undoubtedly a reasonable complaint, and it appears that it is the duty of the city in such cases to so repair the sidewalks that the drainage of property and convenience of pedestrians may not be affected.

Through lack of funds the construction of curbing has not been possible except in particular cases. To make available the storm-water sewers lately constructed a considerable amount of this work must shortly be done. Aside from the drainage question, the construction of curbs influences in great measure the cost of maintenance of the streets. A well-confined street area maintains its condition with less expense than a free roadway. On many streets also the construction of curbing would lessen the amount of street area to be kept in repair, with immediate reduction in expenses.

The system of street signs was improved by the erection of 1,541 wooden signs of an improved type. These signs, while not artistic, are very legible and satisfy temporarily the conditions. The total cost for this work has been ₱674.95, which, considering the convenience and the extent of the work, was a very small expense. As funds are at hand, permanent signs with raised enameled letters should be installed. In the larger public places elaborate signs might be erected with good artistic effect. The system of street names is badly in need of correction, as it is both complicated and confusing. A scheme for renaming all the streets of the city has been under consideration for some time and will be shortly presented to the board. This scheme seeks to preserve the old names and to remove all repetitions.

All the iron and steel bridges have been painted during the year to prevent corrosion and the woodwork of all wooden bridges painted with coal tar to prevent the attacks of insects. In general it may be stated that the condition of the bridges is poor. The Palomar, the Azcarraga, and Bilibid bridges are all in need of rebuilding. The stone arch bridges over the Paco Estero and the Estero de Quiapo are in need of major repairs, as the arch rings show positive signs of movement. The appropriations heretofore allowed have been insufficient to make needed repairs, and in consequence a large amount of money has been expended in work of doubtful value. Because of the shortage in funds, the flooring of the Palomar and Azcarraga bridges were laid with Oregon pine lumber. The inadvisability of this practice has become manifest, as after six months of service the flooring is useless through wear and must be replaced. The appropriations for this work should be generous, as following the opening of the street railway to traffic greater repairs have become necessary on all the bridges crossed by the tracks.

The use of the Bridge of Spain by the railway company has undoubtedly injured the arches, as greater vibrations are now noticeable in the bridge under traffic. These arches will surely not long bear such severe stress as now imposed upon them, and some means should be taken either to replace them or to construct a new bridge close to this crossing. It has been proposed further to increase the headroom of this bridge by raising the arches in one or two spans, so that launches may at all times safely pass under it. This will be an expensive repair and may prove to be inadvisable upon investigation.

A reenforced steel concrete arch of 14 meters clear span with a clearance of 4 meters above mean low water and width of 10 meters between curbs has been built over the San Miguel Estero, under contract with J. G. White & Co. Sidewalks of a width of 1.85 meters were bracketed from the arch, and stairways constructed leading to them. This detail is of doubtful utility, as at present very few pedestrians make use of the steps, seeming to prefer the freedom of the roadway. The foundations for this bridge were for the most part of piling, although in the east abutment a portion of the old abutments, which consisted of heavy concrete blocks, was left in place. At several points running material was encountered, and for a time fears were entertained that the foundations might be insecure. Several additional piles were ordered driven in the doubtful places, and after that no difficulties appeared. The reenforcing of this bridge consisted of 37,500 pounds of three-fourths and one-half inch Johnson bars. The total cost of the bridge, including the additional piles, and reduced by the penalties imposed for delay in completion, was ₱36,029, of which the city paid ₱16,200.54 as its proportion of cost.

A steel lift bridge was built over the Estero Binondo at the foot of Calle Soledad, thereby making a direct connection between the business district and the custom-house. The construction of the substructure of this bridge was advertised for but no bids were received, and the city was compelled to construct the foundations with its own labor. In this bridge, also, a portion of the old foundations laid by the Spaniards was found in good condition and employed in the work. For the foundations of the towers the work was carried on in cribs. This method was employed in order not to interfere with navigation in the estero and was more expensive than would have been the case with work carried on in cofferdam. The city also laid the approaches to the bridge and reconstructed the estero walls where necessary. The contract for the superstructure was let to Germann & Co. for the sum of ₱39,580, and was completed to satisfaction in December. This superstructure consists of a movable platform with a clear roadway of 6.7 meters and two sidewalks of 2.3 meters in width. The span from center to center of supports is 13 meters, and the clear channel between abutments is 12 meters, which is ample for all traffic. This movable platform is electrically operated from a small operating house situated north of the bridge at the Calle Soledad end.

Traffic observations have been made at this bridge, and upon the average for a day of twenty-four hours 13,400 pedestrians and 1,382 vehicles pass over the bridge, while 141 cascos pass beneath the platform. The average cost of lifting the platform, exclusive of repairs, has been, since the date of opening, December 28, 1905, ₱0.27 per lift.

The contract for the erection of the superstructure of the Ayala Bridge was let to the Atlantic, Gulf and Pacific Company in March of last year, but when the steel arrived the abutments and pier were not ready. It had been the original intention to use the foundations of the old Ayala Bridge in the work, but further examination of these structures and consultation with the former city engineer, Señor Don Carlos de las Heras, showed that the safety of the structure might be endangered by their employment. Following this, a new location, with entirely new foundations, was proposed and approved. The Atlantic, Gulf and Pacific Company also secured contract for this construction. Work was further delayed by the noncompletion of the bridge over the San Miguel Estero, which prevented the closing of this river crossing. After considerable difficulties with the foundation and the wrecking of the caisson for the center pier, the work was finished in June. A number of additional piles of greater length than estimated were necessary in both the pier and the abutments.

The false work for the superstructure was commenced in March, and, while the substructure was not finished, the steel was being erected on the south span from the south abutment. When the assembling of the south span had extended to a point within one panel length of the pier, work was abandoned on the south span and the erection commenced from the north abutment. This was necessitated by the delay in placing a second caisson for the pier. The assembling of the entire work was completed in June and the trusses lowered upon their seats. Up to June 30 about 75 per cent of the rivets had been driven, and at the rate of progress the bridge will probably be opened early in August. This bridge consists of two spans of the Pratt double intersection type, with curved upper chord, and is throughout a riveted structure with pin bearings. The bridge has a clear roadway of 6.70 meters, with two sidewalks of a width of 1.75 meters. The floor consists of buckle plates riveted directly to the floor beams. The south span has a length of 202 feet between end pins, and the north span of 242 feet between end pins. It is the intention to lay the roadway with asphalt as an experiment.

In connection with this work it was necessary to widen the approaches and to construct new retaining walls. Land was acquired to the east of the north approach, so as to afford a clear roadway of 8 meters and sidewalks of a width of 2 meters to the centers of the approach railings. It was possible to preserve the west wall of the north approach with some minor changes, but the three remaining walls were constructed from general funds of the department with Guadalupe stone secured from casemates removed from the city walls at Fort Santiago. In all, 1,314 cubic meters of masonry were laid up, at a cost of ₱5 per cubic meter, exclusive of the value of the stone. These walls present a fine appearance and were economicaly constructed.

To accommodate the traffic from the new bridge to the Isla de Convalecencia, a pair of the 12-meter trusses of the old Ayala bridge were erected from the new pier to the old pier, and a solid reenforced concrete floor is being laid. This bridge will be sufficient for all traffic to this institution. The work is being done at city expense.

The remaining trusses secured from the old Ayala bridge are available for erection in various parts of the city. There were secured in all eighteen pairs of trusses of 12-meter span and six pairs of 8-meter span. These are suited for ordinary light highway traffic with some slight changes and repairs. Additional floor girders and stringers are necessary, as considerable corrosion is noticeable in parts near the seats. It is proposed to erect with these bridges crossing the Trozo and Meisic Esteros on the line of Calle Soler. The trusses may be depended on for several years longer, and it seems wiser to employ them as a temporary measure than to enter upon the expense of building permanent steel concrete bridges at these points. There is necessity for a bridge also on the line of Calle Moriones over the Canal de la Reina, and here also the trusses from the Ayala bridge may be employed. If funds may be drawn from the regular appropriation for the department, it is purposed to erect abutments for these bridges and to place the trusses on temporary bridge seats. The form of construction will be such that later the bridges may be altered into arch bridges, although in the case of the proposed Moriones bridge, such change is very remote.

Several of the city bridges are in need of widening, particularly those on Calle Tanduay and on Calle San Sebastian. With the opening of the Ayala bridge traffic along Calle Tanduay will be increased and some additional provision must be made for its accommodation. Widening may be effected by the construction of I-beam sidewalk brackets set in concrete above the arch ring at a very small expense, and effort will be made to accomplish this improvement within the coming year. The bridge on Calle San Sebastian has become a danger point since the opening of the street-railway line. A plan has been completed for the widening of this bridge by means of I-beams set on auxiliary abutments. The intention is to construct a solid concrete floor over these, and to make the sidewalks entirely independent of the arch ring. Work on this bridge will shortly be commenced.

The wooden bridges throughout the city should be replaced by permanent construction. The maintenance cost of these bridges is becoming excessive, and funds should be allowed for their replacement. Wherever possible, a concrete steel bridge is desirable, as the maintenance cost is practically zero.

The occurrence of numerous esteros in the city gives excellent opportunity for improvement in the movement of traffic, but the confinement and dredging of these esteros is necessary in order to realize this condition. These esteros should be dredged to accommodate boats of at least 1 meter draft at lowest tide, and all bridges should have a clearance at mean low water of at least 4 meters, to make possible a thorough use of these natural waterways. For this work a special design for a shallow wall has been worked out, but is not yet in satisfactory condition. A more extensive use of these esteros will be immediately economical for these reasons: First, the streets will be cleared of a large portion of the traffic; second, the cost of maintenance of roadways will be reduced; and third, a reduction in the clear width of the roadway will be possible, thereby saving original cost of construction. The dredgings secured will be available for street filling and for the filling of lowlands. By means of a hydraulic dredger lowlands close to the estero banks could be filled at small cost, and large areas of land at present unsuitable for building purposes would become available. Following the filling, greater receipts could be secured from taxes and the city would be benefited in still another direction. As this work is of great magnitude, it could not be taken up except in small sections, but the esteros which seem to require immediate attention are the Binondo Estero, the San Sebastian Estero, and the Canal de la Reina.

With the development of building construction in the outlying sections of the city, the problem of properly maintaining an increasing area of streets is becoming a serious one. The stone available may be classed as fair, and unsuited to heaviest traffic. With each year the cost of repairs to streets already in existence becomes greater, even though the drainage has been improved by a proper grading in the gutters and by building the roadway with an adequate crown. The argument for permanent paving becomes stronger every day, and undoubtedly it will be cheaper in the end to provide permanent pavements in streets where traffic is heavy, extending the work as conditions warrant to other sections. The Australian wood-block pavement already laid has not proven satisfactory. The blocks are readily attacked by white ants, and as they are untreated and improperly seasoned, rotting, checking, and swelling have been noticed. The molave blocks removed from the Blanco bridge at the time of the laying of the pavement on Calle Rosario were shown to be in sound condition and to have suffered little wear, even though laid for nineteen years. Although these blocks were about twice as expensive in original cost as blocks from Australia, it is now known that their use would have been economical. The pavement laid on the Escolta and Calle Rosario has failed in many places, and within a few years extensive repairs will be necessary. Effort has been made to interest importers and local merchants in the supply of vitrified paving brick, and within a short time it may be possible to lay several trial strips of this kind of pavement. The suitability of asphalt for Manila streets may be determined from the result of experiments on the Ayala bridge. A minor experiment has also been made with the use of oil on macadam streets, but the results have not been satisfactory, in that the correct proportion of oil was apparently not applied. The advisability of laying streets with cement blocks has also been inquired into, and one manufacturer is now endeavoring to produce a block of marketable value.

Late in 1905 the Philippine Islands Telephone and Telegraph Company commenced the laying of conduits for its telephone wires in several of the business streets, employing cement ducts in the construction. This experiment has been watched with much interest, as success in this work will be of immense importance to the city. Apparently the material in the conduit section was improperly tamped or the joints between the sections, where burlap soaked in tar was wrapped, were not made tight, as considerable seepage of water has occurred along the whole line. In part, the seepage is due to filtration through the floors of the manholes, which in the majority of cases are below mean low water. This condition might, of course, have been avoided by waterproofing the manholes. For the remaining portions of the lines the company has employed aërial cables, in part strung from its own poles and in part from the city's poles, under terms of an agreement with the city. This has been a favorable arrangement, as the placing of a large number of poles in the streets has been avoided.

The experience gained in the past year, during the severe typhoon, has clearly shown the inadvisability of permitting the stringing of more wires in the streets. At that time the danger from the falling wires was very great. In addition to this, the streets are badly disfigured by the unsightly poles which have been erected. In the majority of cases these poles are not provided with steps and are mounted by means of linemen's spurs. The scars resulting from repeated climbings heighten their unsightliness. To avoid this condition, all companies should be compelled to provide suitable steps on their poles and mounting by linemen's spurs should be prohibited.

The subdivision of streets as heretofore practiced and as provided for in the building code appears to be in part in error, as too large a proportion of the street area is thrown into roadway, restricting the area for parking. This subdivision results in increased expense for maintenance of roadway and less favorable drainage and does not permit shading the streets with trees. A revised regulation in this direction is desirable, and a scheme for this will be presented to the board.

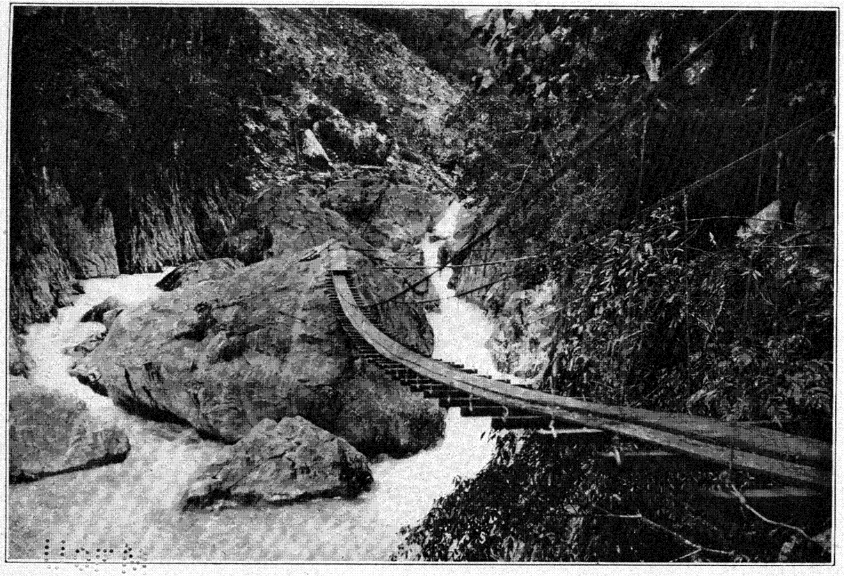
BUILDING AND PLUMBING INSPECTION.

On January 1 the new building code went into operation. This code carried with it certain provisions making for better design in buildings, and, while apparently severe in some details, is in other directions rather lax. A serious omission has occurred in the failure to provide for the construction of reenforced-concrete buildings. Since January three buildings of this type have been in course of erection, and all have been the subject of special investigation to determine their safety. An amendment to the code providing definite conditions for the design would facilitate investigation. Undoubtedly reenforced concrete is the ideal construction for the Philippines, as experience in other sections where earthquakes are frequent has proven conclusively that this method of construction can best resist earthquake shocks. Further than this, the placing of concrete is no difficult matter, and the materials for the construction are always available in the market. The operation of the department under the code has been successful, and while a large number of complaints was entered immediately upon the passage of the code, these have greatly decreased in number as architects became better acquainted with its provisions. The majority of the complaints were concerned with alleged excessive charges. The ideal condition for a tariff under a building code is that the actual cost of the service shall be met by the fees, and from the short experience this seems to have been gained. There have undoubtedly been errors in the schedule, but some of these have been discovered and corrected. Many disputes have also arisen as to classification of work, and interpretations of the code have been made from time to time as necessity demanded.

The section of plumbing inspection has been operating entirely upon regulations prepared by the bureau of health, but this arrangement is unsatisfactory because the requirements are not generally known. The enforcement of sanitary regulations in so far as they refer to drainage, plumbing, and proper building construction lies with the city engineer, under supervision of the director of health; but as at present enforced the regulations divide the responsibility. The proposed sanitary code will clear up many doubtful points and afford a rational basis for the necessary inspections. Undoubtedly the enforcement of this or any code of like nature will meet with opposition in the beginning, but with careful attention to details and a liberal interpretation a reasonable enforcement may be made without great difficulty. The early completion of the drainage sewers requires that an adequate sanitary code be in operation, in order to prevent the entrance of storm water into the drainage system, and it is of maximum importance that this code be in full effect before connections are made to the drainage system.

During the year a large number of light-material buildings were condemned at the instance of the bureau of health. As the majority of these buildings were in the possession of poor persons, some hardship was caused; but each case was carefully considered, and if repairs were possible permission to effect them was granted. It has been claimed that this department has been unnecessarily severe in its rulings, but an inquiry into the records of the bureau of health shows that in a number of cases in which the orders for removal were rescinded by the board fatal cases of cholera have occurred during the present outbreak. In the case of the barrio of Rosario, in which practically all the houses in the barrio were condemned as unfit for habitation, a temporary injunction was secured restraining the city engineer from removing the houses. After a strong contest this temporary injunction was dissolved, but the case was appealed to the supreme court and is now awaiting decision. It is highly important that a case of this kind should be definitely decided, in order that the authority of the city engineer in such cases may be thoroughly determined. The sanitary conditions in this barrio are such that if the city lose the case there can be no hope for condemning houses for any reason. In various other parts of the town sections with almost equal insanitary conditions exist, which in the interest of the public health should be cleared away.

All the city buildings are in need of painting and general repair. Particularly is this the case with the city hall, which presents a very dilapidated appearance. To protect this against further damage, the entire exterior of the building should be thoroughly painted. The roofs and interiors of the fire stations are



GORGE BELOW DAM SITE, HEADQUARTERS NEW WATER SYSTEM.

YLANG-YLANG GROVE AND ENGINEERS' CAMP, HEADQUARTERS NEW WATER SYSTEM.

in need of extensive repairs. During the past year the Quinta and Arranque markets have been painted and Divisoria Market painted in part. The work on the last market will be completed in July. The need of careful inspection of all steel work was very apparent when the old paint on the markets was removed. No attention has been given to this matter for four or five years, and in many parts the steel was badly corroded where the original paint had been worn off through the action of the elements. In no case should the steel in the markets be left without painting for more than two or three years.

CITY SHOPS.

All buildings within the shop inclosure were painted with mineral paint with the exception of the office, which was painted with lead paint, and all are in good condition. No changes were made in the roads or grounds and for all present purposes the yards are of sufficient extent. A small drying kiln, with capacity for 1,000 feet of lumber, was installed at the wheelwright shop by shop labor when other work was slack.

The jobs worthy of special mention completed were:

Manufactured: Seventy-five garbage cans, 300 hatracks, 10 file cases, 750 pail-system commodes, 235 park benches, 1 bear cage, 1 platform pail truck, office signs and directory boards throughout city hall, 2 two-horse dumping wagons, and all hardware specials for banca repair.

Entirely rebuilt: Twenty-seven carromatas, 6 carretelas, 34 handcarts, 2 light spring wagons, 6 escort wagons, 6 trucks, 5 rock beds, 1 excavator, 1 patrol wagon, 1 ambulance, 1 sheriff's van, 14 dump carts, 29 wheelbarrows, 1 fire engine, and 11 stone scows.

Large jobs completed: Recovered fish tables in Divisoria Market, general repairs Paco Crematory, painted Luneta police station, Quinta Market, Arranque Market, and shop buildings.

During the first nine months the shops were run to their full capacity, but for the remainder of the year work was reduced; in consequence, the cost of work was slightly increased. The shops are now equipped to undertake any kind of heavy wagon and machine work.

NOTE.—The following tables accompanying this report are on file in the War Department:

Record, by months, of drafting and surveys completed during the fiscal year.
Operation, in hours, of engines.
Coal consumption.
Pumpage and consumption.
Collectible revenues.
Pipe installations.
Private fire service, by districts, in operation.
Water service, by districts, in operation.
Installation of fire hydrants.
Work done on distribution system.
Meters in operation.
Cost of maintenance, operation, and pumpage and delivery.
Annual variations in water supply and cost and income of same.
Cost of regular sewer cleaning and repairs.
Cost of storm water drain construction.
Boiler inspection.
Cost of labor and work performed.
Cubic meters of material towed by the launches *Washington* and *Jan*.
Location, character, and cost of cement curbs and cement sidewalks installed.
Work performed on streets.
Cost of maintenance of streets.
General repairs made to bridges.
Private building construction and repairs, by months.
Private building construction, repairs, and condemnation, by districts.
Statement of cost of repairing and lighting public buildings, exclusive of markets.
Cost of operating, cleaning, and care of markets.
List showing the new and old buildings in which plumbing has been installed, overhauled, or remodeled.
Distribution and cost of jobs completed (city shops).

Expenditures of the department during the fiscal year 1906.

Salaries and wages:		
Salaries, building and plumbing inspection		₱35,029.26
Labor, buildings and plumbing inspection—		
School janitors	₱11,251.75	
Market laborers	15,052.70	
Janitors public buildings, including police stations	8,921.40	
		35,225.85
Salaries, boiler inspection		3,600.00
Salaries, drafting and surveys		17,513.79
Labor, drafting and surveys		10,544.80
Expenses of Desmond Fitsgerald from Manila to United States		793.00
Salaries, general office		33,682.77
Inspectors, temporary, building inspection		1,708.66
Salaries, street construction and bridges		49,069.70
Labor, street construction and bridges—		
Streets	₱100,221.95	
Stone scows	37,286.25	
Quarry	47,687.55	
		185,195.75
Salaries, repair shops		38,218.48
Labor, repair shops		6,757.27
Salaries, sewers		3,685.02
Salaries, water supply		42,900.81
Labor, water supply—		
Shops	₱23,630.65	
Deposito	4,206.88	
Pumping station	10,969.96	
		38,807.49
Total for salaries and wages		502,732.59
Contingent expenses:		
Advertising		4.86
Repairs to markets and municipal buildings		23,331.18
Repairs to bridges		28,648.19
Operating dredge cleaning esteros		3,188.60
Material for maintenance and repairs electrical service		777.71
Electrical service, public buildings, parks, and streets—		
Electrical service, streets, harbor, and parks	₱86,683.60	
Electrical service, public buildings	21,432.45	
		108,116.05
Purchase and repair office furniture and supplies		5,080.99
Purchase, fuel, oil, and other engine supplies—		
For launches	₱13,590.62	
For quarry	8,082.74	
For repair shops	1,067.66	
For road rollers	3,619.03	
For water supply	35,282.92	
		61,642.97
Incidental expenses		568.90
Maintenance, repairs, and supplies, barges, launches, road rollers, and scows		82,825.75
Repairs, Cuartel Meisic		468.47
Printing and binding—		
General office	₱583.13	
Drafting and surveys	74.02	
Water supply	1,099.52	
Street construction	332.87	
Building inspection	310.91	
City shops	149.44	
		2,549.89
Purchase pump and boiler, rock quarry		2,140.05
Repairs, pumping machinery		859.54
Purchase of pitch for street repair		6,680.00

Contingent expenses—Continued.		
Postage and telegrams		₱53.00
Repairs, launches, and equipment not made at city shops		10,199.69
Rents—		
School buildings	₱51,580.16	
Police stations	4,200.00	
Lands	9,910.56	
		65,690.72
Purchase of material for streets and bridges		38,928.31
Repairs, sewers, and drains		11,229.42
Janitors' supplies		8,362.50
Repairs, Santolan road		7,984.50
Purchase of materials for street signs and numbers		110.93
Subsistence for launch crews		373.70
Telephone service		1,437.68
Purchase of tools and miscellaneous supplies—		
Water supply	₱14,816.24	
Street construction and bridges	13,365.59	
Buildings and plumbing inspection	51.81	
City repair shops	1,685.30	
		29,918.94
Transportation on official business—		
General office	₱1,119.88	
Drafting and surveys	7,082.94	
Water supply and sewers	16,958.90	
Street construction and bridges	64,335.39	
Buildings and plumbing inspection	5,444.93	
City repair shops	733.56	
		95,675.60
Expense closing wells for sanitary reasons		1,113.26
Total for contingent expenses		597,961.40
Aggregate		1,100,693.99

Expenditures, fiscal year 1906, for public works, city of Manila.

Purchase of benches for parks		₱2,967.31
Construction, San Miguel Bridge		18,556.04
Ayala Bridge construction and incidental expenditures		193,259.46
Bridge over Binondo Estero		39,580.00
Construction of cement curbs		8,681.04
Repairs to drains due to filling moat		3,999.98
Foundation and erection, Binondo Lift Bridge		13,593.11
Purchase of land, lot 1, block 47, Ermita		45,009.37
Purchase of grounds and construction of markets, Sampaloc and Paco		11,630.56
Filling moat, material dredged from harbor		70,132.38
Construction and widening Calle Nueva		18,081.65
Purchase of rights and traffic facilities, Vitas Canal		4,000.00
Purchase of seats and hand screws for pails		1,550.67
Preliminary survey, new water and sewer system		925.52
General widening of streets and filling moat:		
Widening streets	₱1,011.78	
Filling moat	952.26	
		1,964.04
Widening and straightening streets generally		135,938.93
Installation new water mains		347.20
Repair and reconstruction, Pasig River walls:		
Construction	₱205,920.44	
Incidentals	462.88	
Inspection	6,010.00	
		312,393.32
Total		782,610.58

Construction of river wall, Pasig River, under supervision of city engineer, paid from insular funds (Act No. 669):		
Salaries and wages, inspection		₱6,065.60
Contingent expenses—		
Contract	₱236,970.29	
Cement	23,549.29	
Miscellaneous materials	1,058.08	
		261,577.60
Total		267,643.20

POLICE DEPARTMENT.

Act No. 286 of the Philippine Commission, dated October 31, 1901, authorized 834 men as the strength of the police department. This limit was not changed until the month of June, 1906, but various reductions had been accomplished in accordance with the annual appropriations. A short time before civil government was established in 1901 the police department, under the direction of the provost-marshal, had enrolled about 2,000 men, Americans and Filipinos, on duty within the limits of the city of Manila. Between 1901 and 1904 the force was gradually reduced until the average for the fiscal year 1905 was 715 men. In the fiscal year 1906 the force averaged 700 men. On the 1st of June of the same year this number had been reduced to 679, and then, under the stress of urgent economy, a further cut was made to 646 men. On June 9 the Commission directed that the force be reduced to not more than 500 men, of which the Americans shall not exceed 200, including sergeants, and it was further ordered that the police department be maintained on a basis of ₱837,500 per annum. On May 29, after a careful consideration of the reduced income of the city, principally due to the transference of approximately ₱900,000 per year to the insular treasury by virtue of the operation of the new internal-revenue law, which sum had previously been collected in the city of Manila and credited to the municipal treasury, the board resolved that the police department should be reduced so that the annual cost of maintenance should not exceed ₱900,000.

When the Commission considered the deficiency appropriation for the various departments, presented by the municipal board in the month of May, no provision was made for covering the deficiency asked by the police department beyond what might be gathered by the transference of certain small unexpended balances from the last general appropriation bill. The actual situation and the immediate and severe effect on the police department of such failure to appropriate for the deficiency was clearly outlined to the Commission, but, no relief being obtained, the municipal board had no choice other than to summarily reduce the strength of the department. Accordingly, the first cut was made by dropping thirty-three first-class policemen on June 3. The board, endeavoring to protect the city's interests, requested the governor-general to take up with the Commission a proposition to declare the fiscal year 1906 as of eleven months' duration for the benefit of the police department and to permit the apropriation for the fiscal year 1907 to cover thirteen months, namely, from June 1, 1906, to June 30, 1907. This plan would have permitted a gradual reduction in the department, which would have avoided hardships to those men who were to be dropped from the rolls, and by careful adjustment the police work would not have been prejudiced; and, it is believed, that at the end of the period the department would have been operating satisfactorily within the prescribed appropriation. As this plan was not adopted, it was requested that the Commission carefully consider the actual condition of the police department, with a view to reconsidering its denial of the deficiency appropriation, which denial, in a large measure, was an abrupt departure from the practice long established of granting deficiency appropriations in the last half of each fiscal year for the various municipal departments, as well as the bureaus of the insular government. It was suggested that this investigation be made through the reorganization committee.

Such an investigation was made, and as a result, the maximum force was set at 500, exclusive of the secret-service bureau; moreover, the policemen who had been dropped from the rolls on June 3 on three days' notice, which reduction could not be avoided under the decision of the Commission to not grant any deficiency for this department, obtained relief by being returned to duty as of date of removal and continuing on duty on regular pay until June 15. This measure gave the men affected a few days more time in which to seek other positions.

The municipal board has repeatedly requested that the city be reimbursed for the cost of service of policemen detailed on purely insular work, such as the guarding of the printing plant, the treasury, the auditor's office and Ayuntamiento, the residences of certain members of the Philippine Commission, the dormitory of the normal school, etc., amounting in all to approximately ₱54,840 for the fiscal year 1906, with corresponding sums for the previous fiscal years. These requests were based on the verbal agreement made by the then civil governor, at the time it became necessary to largely increase the guards on the treasury and other insular buildings in 1902. The plan then adopted was that the board should detail the guards to the insular bureaus, etc., upon the request of the proper authority and that reimbursement should be made from the appropriations of the bureaus and from such other sources as required the additional protection; but the city has not been reimbursed, and when the reorganization committee convened with the board the idea was introduced to consider the heavy expense thus imposed on the municipality as included in a part of the work expected to be enjoyed at the expense of the municipality in return for the 30 per cent of the expenses of the city of Manila annually appropriated from insular funds. This theory is something of a surprise to the board for the reason that when in the charter of Manila it was stipulated that 30 per cent of the municipal expenses shall be paid from the insular treasury and that as part consideration of the contribution of this 30 per cent it shall be lawful for the insular government to appropriate to its use temporarily the building known as the Ayuntamiento, it was not presumed that the city would be expected to render dollar for dollar in service. As a matter of fact, each year the city has been performing increased service for the insular government, usually without recompense, on the basis that this additional expenditure of municipal revenues was merely returning to the insular government a part of the 30 per cent of the expenses which it contributed. If this same reasoning be carried out the city may ultimately perform work which will approach the value of the 30 per cent in question, and therefore this apparent assistance may ultimately disappear. At the present time there is no direct contribution to the city of the full 30 per cent of its annual expenses, because this percentage is largely reduced in the expenditure of municipal appropriations for the direct benefit of those departments of the insular government established within the city. At the end of the fiscal year 1906 the police department alone performed work of this character at an expense of approximately ₱54,840.

The total amount expended by the city in payment of salaries of policemen detailed on special duty at the direction of the insular government since the establishment of civil government in Manila, exclusive of sanitary details, to June 30, 1906, is approximately ₱280,000.

At the same time that the force was reduced to 500 men the Commission recognized the agreement referred to above and gave relief to the city by directing that not more than 6 American policemen be detailed for the insular service, of whom 3 were to be stationed at the Malacañan and 3 at the Ayuntamiento, and further, in case the sanitary exigencies of the city are such as to demand a greater force than 20 men assigned to the direction of the bureau of health, that special authority be granted for such increase, and that such excess shall be allowed in excess of the total number of 500 above mentioned. The bureaus requiring special guards have secured sufficient money in their annual appropriations to hire their own men, and, as a rule, these places have been given to policemen who were recently discharged in order to accomplish the required reduction in the force.

Under act No. 1421 provision was made for the following officers: One chief, 1 assistant chief, 1 inspector, 1 surgeon, 1 assistant surgeon, 7 captains, 3 lieutenants (Americans), and 3 lieutenants (Filipinos).

The following have not been requested for the following year on account of the reductions effected during the year by the chief of police and the recent reduction due to the reorganization of the force: One inspector, 1 surgeon, 1 assistant surgeon, 1 captain, 3 lieutenants (Americans), and 3 lieutenants (Filipinos).

Act No. 1421 provided for an office force as follows: One clerk, class 6; 1 clerk, class 7; 1 clerk, at ₱3,000 per annum; 3 clerks, class 8; 3 clerks, class 9; 2 clerks, Class A; 1 Chinese interpreter; 2 clerks, Class D, and 3 messengers, at ₱2,400 per annum.

The following have not been requested for the coming year· One clerk, class 8; 1 clerk, class 9, and 2 clerks, Class D.

Act No. 1421 provided for the secret-service bureau as follows: One chief of secret service; 1 detective, at ₱4,000 per annum; 1 detective, at ₱3,600 per annum; 1 detective, at ₱3,200 per annum; 1 detective, at ₱3,000 per annum; 1 detective, at ₱2,800 per annum; 5 detectives, at ₱2,400 per annum; 2 detectives, at ₱2,000 per annum; 1 detective, at ₱1,800 per annum; 3 detectives, at ₱1,200 per annum; 3 detectives, at ₱960 per annum; 6 detectives, at ₱480 per annum.

There has been no change made in the personnel of the secret-service bureau for the coming year, with the exception of the promotion submitted for Mr. John W. Green, who has on several occasions been in charge of the bureau during the absence of its chief.

Act No. 1421 provided for first-class police as follows: Twenty-three sergeants, at ₱2,600 per annum; 23 roundsmen, at ₱2,400 per annum, and 324 patrolmen, not to exceed ₱660,000.

The following have been requested for the coming year: Thirty-two first-class sergeants and 168 first-class patrolmen.

Act No. 1421 provided for second and third class police as follows: Second-class—Eighteen sergeants, at ₱1,200 per annum; 18 foundsmen, at ₱960 per annum, and 100 patrolmen, not to exceed ₱80,000. Third-class—Ten sergeants, at ₱720 per annum; 10 roundsmen, at ₱600 per annum, and 284 patrolmen, not to exceed ₱178,000.

The following have been requested for the coming year: Sixteen second and third class sergeants and 284 second and third class patrolmen.

Act No. 1421 provided for a launch crew of 19 employees and an aggregate salary list of ₱6,880. This does not appear on the estimate for the coming year, as the entire crew has been discharged and the launch laid up. The rowboats have been turned into the city shops.

The material reductions indicated in the above statements throw considerable additional work on every member of the force. The short experience already gained does not warrant definite criticism on the effect of the general efficiency of the department, or the proper guarding of the property and lives of the citizens of this city under the reorganization scheme.

In the future adequate provision will be made for reimbursement to the police department for all the special work done for other departments of the municipality; for instance, during the past year from time to ime as many as 12 or 15 policemen have been employed in guarding prisoners working on the improvement of the cemetery and the removal of certain stonework and on other public works of the city, the salaries of which men were charged to the police department, although the services rendered were enjoyed by the department of engineering. The change is merely in line with the established custom of interdepartmental charges; thus all repair work for the police department and labor and materials supplied by the city shops is a charge against it and a credit to the department of engineering. For several months a policeman was detailed in the department of engineering as a plumbing inspector while the regular inspector was absent on accrued leave, but the former's salary was paid by the police department. Similarly, two policemen were detailed in the electrical branch of the fire department because the department had no available appropriation for the hire of men, and these two salaries were paid by the police department without interruption. Other cases can be cited, and undoubtedly these services have been of great value and substantial accommodation. It has been most convenient to call on the police department for a detail of men for work in various other city departments, but it is only reasonable and fair that corresponding reimbursement should be made.

The municipal board and the officers of the police department have done everything in their power to assist the policemen who were dropped by reason of economy to secure positions, and, in the majority of cases, those men who have good records as policemen have been established in other branches of the service and in business houses.

The cost of the maintenance of the department during the year was as follows: Salaries and wages, ₱1,097,536.57; contingent expenses, ₱58,381.32.

Of these expenditures a refund has been made from the sales of uniform material in the amount of ₱11,019.

During the year 54 appointments were made, of which 12 were Americans and 42 Filipinos; 993 applications were made for accrued leave, 370 by Americans and 623 by Filipinos; 2,357 applications were made for vacation leave, of which 1,243 were made by Americans and 1,114 by Filipinos; on detached service, Americans 3; discharges, 249, of which 116 were Americans and 133 Filipinos; there were 14 transfers made from this bureau, 9 Americans and 5 Filipinos; 6 promotions were made, 2 Americans and 4 Filipinos; transfers to the department, 1 American; reinstatement, 1 American, 2 Filipinos; reductions 43, Americans 23, Filipinos 20.

The patrol wagons of the department responded during the year to 1,648 calls; 1,421 were ordinary calls and 227 "fast" calls. Nine hundred and eighty firearm permits were issued; 241 renewed, and 336 canceled.

Pound.—The city poundkeeper impounded during the year 2,276 dogs, of which disposition was made as follows: One thousand five hunded and seventy-four were cremated, 451 redeemed, 216 released, 5 turned over to bureau of government laboratories, 8 escaped, and 19 on hand. He also impounded 20 horses. 102 ponies, 7 mules, 137 hogs, 116 goats, 4 sheep, 41 carabaos, 6 cows, and 4 deer, and collected fees to the amount of ₱4,055.15.

Health.—The health of the department during the past year has been excellent. Eight deaths occurred, 6 of which were the result of natural causes, 1 by suicide, and 1 killed by live electric wire.

Police fund.—This fund has decreased owing to the number of deaths and the disinterring of the bodies of eight American policemen in the National Cemetery and reinterring in the Cemeterio del Norte and the removal of the body of one native policeman from paupers' lot to Cementerio del Norte, music at funerals of deceased members, and a present of ₱100 to the destitute widow of Mamerto Picardal. The receipts for the year amounted to ₱2,102.74, while the expenditures amounted to ₱3,180; total remaining on hand June 30, 1906, ₱5,478.16; of this amount ₱5,440 is on deposit in the Chartered Bank of India, Australia, and China, and ₱38.16 is under the care of the storekeeper of the department.

Confiscated, found, and stolen property.—Three hundred and six entries of the above have been received during the year, making a total of 1,727 entries in a little over five years; 102 were disposed of at auction November 21, 1905, for the sum of ₱97.62, and 72 entries on May 24, 1906, for ₱123.17.

Prisoners arrested.—During the year 11,992 arrests were made, which is a decrease of 1,671 from the previous year. The chief causes of arrests were:

Gambling	2, 695	Blocking highway	469
Embezzlement	1, 446	Vagrancy	409
Disorderly conduct	1, 170	Assault	358
Theft	608	Larceny	279

It is to be noted that there was very little violent crime. There were but 2 cases of attempted murder, 7 of murder, 8 of assault with a deadly weapon, 3 of assault with intent to kill, 1 of attempted suicide, 6 of frustrated murder, 11 of rape, 1 of frustrated homicide, and 3 of homicide. The principal offenders were: Filipinos, 9,223; Chinese, 1,739; Americans, 725; Japanese, 112; Europeans, 87; Spaniards, 64.

Summary court.—There were 281 cases tried during the year by the assistant chief of police, who acts as summary court officer. Many of these men were discharged, others fined and censured.

Typhoons and care of destitute persons.—On the 26th of September, 1905, a severe typhoon passed over the city, causing many people to be homeless, and the police department rendered all assistance possible. Men on leave and sick performed almost continuous duty in the saving of lives and property, and bringing to the different stations those who were in need of food and shelter. Twenty-three sacks of rice and 31 cases of salmon were obtained from the civil supply store of the bureau of constabulary and distributed to the destitute. During the raging of this typhoon Patrolman Alfonso Sobrevilla was killed by fallen live telephone wire while in the act of endeavoring to rescue a small boy who had come in contact with the same wire. Salary due him, together with his accrued leave and subscription, amounting to about ₱800, was turned over to a committee appointed by the department for the purpose of taking care of his wife and children.

Reappearance of cholera.—During the month of August, 1905, cholera made its reappearance in the city, the first case being in the district of Sampaloc. Owing to this epidemic the police have a great deal more work to perform, being used as guards at all houses where the disease is discovered. They also assist in preventing the sale of prohibited foods, etc.

Processions.—Religious processions in the city of Manila occupy a great deal of the time of this department. As a rule these processions require the time of from twelve to fifteen men for one or two hours to handle the crowd. The following indicates approximately the service so rendered:

Total number of police used	3, 710
Total hours of duty	13, 702
Processions and festivals	207

So that it can be seen that with the number of processions in the city during the year the services of policemen necessary to handle the crowd and length of time employed are costly. Theaters, cinematographs, banquets, etc., also take up considerable time of the police department.

Cooperation with constabulary.—Cooperation with the Philippines Constabulary and the military authorities continues to be excellent, as in the past. The only friction which has arisen between this department and the Philippines Constabulary has been over the right to arrest in Manila. This matter has been satisfactorily arranged and is now working nicely.

Consolidation and transfer of stations.—The river and harbor police of San Fernando station were transferred to the building better known as the captain of the port's office. This station is now consolidated with Cuartel Meisic and no records of any kind are kept at this station. The police of Santa Cruz and Anloague have also been consolidated with those at Meisic. Through the consolidation of the police, the following stations have been vacated: Anloague, American and native; Santa Cruz, American and native; Sampaloc, native.

Longevity pay.—At the time the estimates for the appropriation were considered by the municipal board, under the stress of rigid economy which was then being enforced, the board decided to suspend the operation of the longevity-pay system in the police and fire departments for the present fiscal year. Moreover, the report of the organization committee on the changes in the police department, which was approved by the Commission, provided a maximum sum for the operation of the department for the coming year, which did not admit of the increase in salary due to length of service as based on the accepted system of longevity pay.

The committee on police has recommended that the board reconsider this action, the expediency of which is open to question in view of the small amount of money involved and the dissatisfaction which may be aroused among the members of the force, with more or less reason. The number of men affected by the increase of pay is smaller than appeared at the former consideration of the matter. A large majority have already enjoyed the full operation of the longevity pay and are not now subject to further increase on account of continuous service, but must look to promotion in rank as a means to increased salary. The number of men in the police department to be affected by this suspension is as follows:

First class:	
47 from ₱2,160 to ₱2,280	₱5, 640
9 from ₱2,000 to ₱2,160	1, 440
2 from ₱1,800 to ₱2,000	400
Total (58)	7, 480
Second and third class:	
43 from ₱660 to ₱720	2, 580
24 from ₱600 to ₱660	1, 440
10 from ₱480 to ₱600	1, 200
Total (77)	5, 220
Aggregate	12, 700

which is the amount the police estimate would have to be increased in order to give all the men in the classes affected the extra pay allowed under the longevity system; but inasmuch as this increase is to be allowed only to those whose services are entirely satisfactory a small reduction may be made in view of those cases wherein the services have been such as would not warrant the increase.

Mounted detachment.—At the close of the fiscal year, on account of the enforced economy, this detachment was dismounted and horses, equipment, etc., were turned over to the superintendent of sanitation and transportation.

Arrangements have been made whereby, when necessity demands it, such as at present processions and in reconnoitering the outlying districts in the event of disturbance, horses may be obtained. With this change it will not be possible to patrol the city limits in as efficient a manner as in the past, which region is occupied by a more or less lawless element usually found in the vicinity of cockpits, gambling houses, etc.

Uniforms.—On February 1, 1906, the first-class (American) policemen reverted to the original khaki uniform, experience having shown that nothing is so satisfactory in wear, cost, and general comfort. The second and third class (native) policemen made a similar change on April 1, 1906, and the new uniforms have not only proven more satisfactory than the old canamo, but have very much improved the appearance of the wearers.

Police surgeons.—The work which was formerly performed by the two police surgeons is now being done by the doctors of the bureau of health and the former have resigned. The district stations of the bureau of health have been established in the various police stations, and the district doctors attend to all cases of sickness not requiring hospital care. This results in economy to the police department in the saving of the salary of the two surgeons and to the bureau of health in the saving of rental of district offices and storerooms.

Bribery.—Capt. Jack Dowson, formerly commanding officer of precinct No. 3, was charged with accepting of bribes to permit gambling in his precinct and to give police protection to the players. After a careful examination by the chief of police and his assistants, the evidence was transmitted to the municipal board and that body made a searching investigation which resulted in the final dismissal of the accused captain. He was tried on other charges in the court of first instance and acquitted. This is the first serious case of this nature which has occurred since the organization of the police department.

Secret service.—The secret-service bureau recovered stolen property to the value of ₱29,055.84 and stolen money to the amount of ₱4,153.37. The Bertillon system of criminal identification, installed last year, is now in full operation, and as the employees are more familiar with the details the service is becoming much more valuable. The bureau has conducted a large number of investigations for the insular government, in addition to the municipal work, and during the last few weeks of the fiscal year several of its members were steadily engaged in obtaining information for the board of pardons, recently appointed by the governor-general to make recommendations for the release of certain men who were serving terms in Bilibid prison.

Experience has shown that it would be greatly to the advantage of the police department to require all persons operating bancas in Manila Bay and the Pasig River to be registered at the police station nearest the water front. Owing to the numerous crimes committed on the river and water front such registration would facilitate investigations.

LAW DEPARTMENT.

OFFICE OF THE CITY ATTORNEY.

The maintenance of the force of this office costs ₱15,220 annually. It is composed of 10 employees, of which 3 are Americans and 7 Filipinos, to wit: One city attorney (Filipino), 1 assistant city attorney (American), 2 clerks class 6 (Filipino), 1 clerk class 7 (American), 2 clerks class 8 (1 Filipino and 1 American), 2 clerks class 9 (Filipino), and 1 messenger (Filipino).

From the comparative study of the work done in the year ending June 30, 1906, with that of the previous period, it is drawn that while the labors of an administrative character have decreased in the former, those of a judicial nature have increased, and it can be asserted as a fact that the volume of work accomplished by this office in the two years is almost the same.[a]

It is worthy of note that while one of the principal functions of the city attorney, as per section 38 of the Manila charter, is to make investigations regarding any city official accused of negligence or bad conduct in the performance of his office, as likewise regarding any person alleged to have violated any franchise or privilege granted by the city, there is no record in the résumé of labor done by this office of any matter of that nature, notwithstanding that investigations of complaints of this kind have been held.

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[a] The résumé of the administrative and judicial labors for the fiscal years 1904–5 and 1905–6 is on file in the War Department.

It would therefore be advisable in the future that all these investgations be held by the city attorney, excepting those of acts subject to discipline committed by members of the police and fire departments, because for those the chiefs, respectively, are empowered by sections 35 and 45 of the Manila charter.

OFFICE OF THE PROSECUTING ATTORNEY.

The appropriation for this office for salaries is ₱44,860. Its personnel consists of 14 employees, 7 of which are Americans and 7 Filipinos, as follows: One prosecuting attorney (American); 5 assistants, of whom 2 are Americans and 3 Filipinos; 7 clerks, of whom 4 are Americans and 3 Filipinos; 1 messenger.

The excessive labors weighing upon this office in previous years have diminished, as may be seen by the following table:

	1904-5.	1905-6.
Investigations made	4,080	4,619
Cases in court of first instance	611	480
Cases in municipal court	862	3,122
Total of cases filed	1,473	3,602

During the last year fewer cases have been filed in the court of first instance as compared with the previous one, due principally to the disappearance of the brigandage cases that were so troublesome in former years.

The considerable increase of cases filed last year in the municipal court, as compared with those filed during the previous one, is accounted for because since January last an assistant from this office acts in all and each one of the cases filed in that court, while prior to said date the prosecuting attorney intervened solely in such cases as his office prepared for proscution.

This office was in charge of Hon. C. H. Smith until March 25 of this year, when he resigned, owing to his appointment as a judge of first instance. Mr. Aylett R. Cotton, an attorney at law practicing in the city of Iloilo, was appointed to substitute Judge Smith under date of April 1 last.

OFFICE OF THE MUNICIPAL COURT.

The personnel of this office costs ₱16,520 per annum, consisting of 7 employees, of which 2 are Americans and 5 Filipinos, to wit: One judge (American), 1 clerk (American), 3 assistant clerks (Filipino), 1 interpreter (Filipino), and 1 messenger (Filipino).

There are, moreover, 3 American and 1 Filipino police officers permanently detailed for service in the court.

The business during the past year has been less than in the previous term, as may be noticed by the statement below:

Cases during the years 1904-5 and 1905-6.

Disposition.	1904-5.	1905-6.	Decrease.
Complaints filed	8,328	7,130	1,198
Defendants tried	12,808	11,122	1,686
Males tried	10,854	9,415	1,439
Females tried	1,954	1,707	247

OFFICE OF THE REGISTRAR OF DEEDS.

This office is served entirely by 8 Filipino employees, implying an expense of ₱9,720, and classified as follows: One registrar, 1 deputy registrar, 5 clerks, and 1 messenger.

These employees do considerable clerical work. Besides attending to the registry books corresponding to the city of Manila, they also keep the registry books belonging to the towns of Pateros, Taguiik, Pineda, Paranaque, Las Pinas, Muntinlupa, San Pedro Macati, San Felipe Neri, San Juan del Monte, Pasig, Kainta, Taytay, Mariquina, Antipolo, Angono, Binagonan, Cardona, Morong, Barras, Tanay, Jalajala, Pililla, Teresa, Caloocan, Tambobo, Navotas, Novaliches, San Mateo, Montalban, and Bosoboso, of the province of Rizal. Up to the present time no definite arrangement has been made to terminate this inconsistency; and although no new registrations are entered in the registry books of the afore-mentioned towns, nevertheless all actions subject to registration relating to property already registered and all certificates of registration of said property are being attended to by this office.

If to the foregoing be added that the mortgage law requires that all these registrations must be written by hand in said registries, the strenuous work of this office to keep registrations to date can be easily understood.

Again, during the year ending June 30 last there has been an increase in the number of registrations of titles and also a greater number of mortgages and reversion sales as shown by the statement on file in the War Department.

The increase in sales and in liens upon city real estate and the decrease in redemptions are very eloquent data to appreciate the general economic conditions.

For the purpose of remedying certain complaints regarding delay in the dispatch of matters in this office, it was decided in March last to add one more clerk of Class I and to provide it with suitable cabinets wherein to guard all the registration books and other documents which had theretofore been kept in the vault of the department of engineering, which vault, being situated two floors below this office, was a cause of difficulties and loss of time in its labors.

It would be advisable to enact the necessary laws limiting this office to keep the registry books of property comprised within the municipal radius of Manila, since by the act (No. 1508) establishing the chattel mortgage the labors of this office will be considerably increased as soon as it is put in force.

COURTS OF JUSTICES OF THE PEACE.

There are two courts of justices of the peace in the city, wherein all the employees, three in each court, are Filipinos. The salaries of each court amount to ₱2,832 per annum.

One of these courts has always been located within the Walled City and the other on Anloague street until January 20 last, when it was moved to the Walled City also, and both are now located in the supreme court building.

The belief in the need of two justices of the peace courts in two different districts of the city is unwarranted, since no disturbance has been noticed by their concentration in the Walled City.

The business done by these two courts in the last two years is stated in the following table:

Nature of work performed.	1904-5.	1905-6.
Suits tried	1,903	1,815
Affidavits taken	117	41
Articles of assignment drawn	32	13
Marriage certificates recorded	2,302	1,536

From the examination of the foregoing table it is inferred that the labors of the courts of justices of the peace have diminished considerably within the last year, so that the two courts could be consolidated into one, with one justice, one clerk, and a messenger, to whom greater salaries could be assigned than those now drawn by them.

OFFICE OF THE SHERIFF OF MANILA.

The force of this office costs ₱19,150 per annum, and is composed of 3 American and 12 Filipino employees, plus 6 laborers permanently in service, as follows: One sheriff (American), 2 deputy sheriffs (American), 7 deputy sheriffs (Filipino), 2 prisoners' guards (Filipino), 1 driver (Filipino), 2 clerks (Filipino), 1 janitor (Filipino), and 6 Filipino laborers.

In the warrants for arrest this office has been aided by the secret-service officers.

Its labors have notably decreased in criminal cases and have increased in civil cases, as may be seen below.[a]

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[a] Statement on file in the War Department.

The increase in civil matters has also augmented the fees collected by this office. The following fees were collected during the years 1904–5 and 1905–6: 1904–5, ₱12,777.03; 1905–6, ₱14,867.23.

FIRE DEPARTMENT.

The personnel of the fire department for the fiscal year 1906, including officers, consisted of 146 men. Of this number 83 were first-class firemen, 2 of which were Filipinos, and 61 were second class (Filipinos). Of the total of 146, 8 men were occupied in the work of the electrical branch. The department is divided into 7 engine companies, 4 chemical companies, 2 hook-and-ladder companies, and it is housed in 7 stations, all of which belong to the city, except No. 4, Intramuros station, which property is claimed by the insular government.

CHANGES AND RECOMMENDATIONS.

In the last appropriation bill provision was made for 12 foremen, 7 engineers of the first class (Americans), and 7 engineers of the second class (Filipinos). During the year the number of foremen was reduced from 12 to 9 by taking advantage of resignations and separations occurring in this rank. It is proposed to further reduce this number to 8 foremen, and provision has been made for such change in the estimate approved by the board and now before the Commission awaiting consideration. It is also proposed to reduce the 7 engineers of the first class to 5, and to increase the number of second-class engineers to 9. It is the aim of the department to promote Filipinos to responsible positions as soon as they show themselves capable of performing the higher duties. The promotion of two Filipinos to the engines will be in the nature of an experiment, which will be carefully observed because of the importance of the work to be performed by these men. Filipino engineers have been employed in the department as second-class engineers on apparatus of lesser importance for some time. Under the close observation and careful instruction of the chief engineer it is believed that the experiment about to be inaugurated will be successful.

Up to June 30, 1906, the electrical branch consisted of 1 city electrician and deputy chief, 1 assistant electrician, and 6 linemen, 2 Americans and 4 Filipinos. The reorganization, as contemplated in the estimate approved by the board, provides for the elimination of the position of assistant electrician, and relieves the city electrician of the duties of deputy chief. This reduction is believed to be feasible, owing to the practical completion of the police and fire-alarm system. During the past three years this work has been very heavy, but from now on the extensions required from time to time can be made by the reduced force.

On January 30, 1904, the municipal board adopted a resolution placing the direct supervision of the lighting of public buildings and places under the city electrician, but requiring all vouchers and accounts pertaining to the same to be signed, as heretofore, by the city engineer, after being approved by the city electrician, and it further provided that the work of the inspection of buildings shall be transferred from the building inspector to the superintendent of buildings and illumination. This practically amounted to an amendment to section 33 of the city charter, but that amendment has not been enacted. Therefore, the change in the administration of the fire department, which was temporarily effected pending the enactment of the amendment, has not been strictly legal. It was urged by the then committee on fire that the change provided in the resolution would produce economy and, at the same time, improve efficiency, but experience has shown very definitely that the consolidation is not a success. The last estimate of appropriation provides for the limitation of the duties of the city electrician to purely electrical work. The construction and operation of some 40 miles of electric street railway and the gradual installation of an entirely new system of electric street lighting, together with the installation of a new telephone system and the removal from the streets and public places of the old telephone and electric systems, have so added to the labors and the importance of the electrical department that it becomes absolutely necessary for the city electrician to devote his entire time to this particular work.

An alternative estimate has been submitted to the municipal board, wherein it is provided that the city electrician shall have entire charge of all matters pertaining to the use of electricity in the city. At the present time the responsibility for supervision, checking, and payment of the public lighting in the streets and plazas, and also in the public buildings, is divided between the city engineer and the city electrician, with the result that the efficiency of the department is lowered and there are numerous conflicts between the two officials. The city engineer is thus required to sign vouchers which he has no way of checking or of conclusively determining the accuracy, and he is obliged to rely on the reports of the superintendent of buildings and illumination and the city electrician. The last named is the only official who can properly handle such matters, and the entire responsibility and authority should rest with him. The committee on fire has prepared a plan for the consolidation of the electric work of the insular government of Manila with the office of the city electrician, which has been discussed by the municipal board and referred to the reorganization committee for its consideration. The matter will be discussed at the time the estimates are being considered by the Commission, and should the plan be approved it is believed that economy and better administration will be effected.

Owing to the failure of the consolidation of the offices of the city electrician and deputy chief, it has been found necessary to detail one foreman to headquarters, designating him temporarily as subdeputy chief, to perform the duties imposed by the rules and regulations. This officer is required to make the inspections of inflammables and explosive material, and also conducts the summary court. It is recommended that the position of deputy chief be restored at the old salary of ₱3,600 per year. By promoting a foreman to this position his salary will be increased ₱600 per annum, provided, however, that not more than ₱3,200 shall be appropriated for the fiscal year 1907.

Fire protection on the river and bay.—On January 28, 1906, arrangements were made with the director of navigation for the use by the fire department in case of fires in the shipping on the river and on the bay and along the water front of the launches *Bohol*, *Cuyo*, and *George Tilly*, which are equipped with fire pumps, and a gong was installed on Engineer Island. The capacity of the department was thus greatly increased. The *Bohol* and *Tilly* have the advantage of being able to pass under the bridges at almost any stage of the tide.

Previous to this time the only protection of this class consisted of the fire pumps on the police launch *Buckey O'Neill* and the sanitary barge *Pluto*. On May 24, 1906, the director of navigation rescinded this arrangement, which operated practically to put all the launches of his bureau at the immediate command of the fire department in case of a marine fire, by imposing the requirement that in each individual case the permission of the director for the use of the launches of his bureau should be received before they could respond to an alarm. As one of the chief elements in fighting fire is the abilty to reach the conflagration in the quickest possible time, the main advantage in the use of the launches has therefore been lost. However, when the department needs the launches fitted with fire pumps, every effort will be made to communicate with the director and obtain his permission. In the plan of the organization committee of the insular government concerning the police department of the city of Manila, which plan was approved by the Commission, no provision has been made for the retention in the service of the police launch *Buckey O'Neill*, and on June 30, 1906, the crew was discharged and the launch went out of commission. If it is restored to service in some bureau of the insular government, it will be outside the jurisdiction of the city and its value for fire-fighting purposes will be approximately the same as the launches of the bureau of navigation. This reduces the city's equipment for marine fire service to the pumps on the sanitary barge *Pluto*. As this barge makes daily trips to the dumping grounds at least 10 miles down the bay, it will not be available for several hours each day. With these statements there is obviously no need for a further explanation of the fact that the river and bay shipping and much of the water-front property are deprived of any adequate fire protection, and it is recommended that provision be made for more convenient use of and greater jurisdiction over the launches which are fitted with fire pumps. The services of the police launch, when fighting fires under the direction of the fire department, have been valuable.

Contracts have been awarded for the construction of wharves and warehouses for the quartermaster department of the Army and for the civil government, and with the improvement of the reclaimed area and the attraction of offices and warehouses to the site of the new harbor south of the river the demand for marine fire protection will naturally be much increased. Shipping will be more centralized and the lighterage and storage of cargo will occupy a more restricted area. In addition to the increase in the equipment of the department, designed to protect this important section against fires in the harbor, special attention should be paid to the extension of the system of hydrants which will be installed on the reclaimed area.

On the recommendation of the committee on fire and the chief of the department the present estimate of appropriation provides for a change in the title of the grades of foremen and assistant foremen to captain and lieutenant. These titles were formerly employed in the department, and, though the first titles have been officially used for the past year, nevertheless the old titles are used by the public and by the majority of men in the department, and there appears to be no good reason why they should not be again used; moreover, the men desire the restoration.

On January 30, 1906, the Commission passed an act granting permission to the Manila Electric Railway and Light Company to construct tracks and overhead work in the city of Manila, traversing certain streets in the walled city, along the glacis, and looping the quartermaster storehouses, thus giving communication with the reclaimed area of the water front for the purpose of carrying freight and parcels. On the same date the Commission granted a franchise to Charles M. Swift to construct, maintain, and operate an electric railway and an electric light, heat, and power system from a point in the city of Manila in an easterly direction to the town of Pasig in the province of Rizal. When this railway is constructed it will give quick communication between Manila, Fort William McKinley, and Pasig, and will add much to the accommodation of the people in these places, between which there is rapidly increasing traffic.

On July 6, 1905, the Commission granted a franchise to the Philippine Islands Telephone and Telegraph Company to construct, maintain, and operate telephone and telegraph systems and to carry on general electrical-transmission business in and between the provinces, cities, and municipalities of Luzon. This franchise is not exclusive, and preserves the right to the government to regulate the rates to be charged by the grantees. It anticipated the purchase of the franchise of the Sociedad de Telefonos de Manila by providing that all the rights and privileges acquired by such franchise should be considered as merged in the new franchise and that the old franchise should have no force or effect whatever after the said purchase. After much negotiation the purchase was effected, and preparations are now being made to remove the obsolete lines and fixtures of the Sociedad de Telefonos de Manila. In lieu of taxes on the franchise or earnings the Philippine Islands Telephone and Telegraph Company is required to pay to the insular treasurer each year 2 per cent of the gross receipts of the telephone and telegraph and other electrical-transmission business transacted under the franchise. At the time the franchise was under discussion a representative of the municipal board introduced a provision to the effect that the 2 per cent of the gross earnings of the company in the city of Manila should be paid to the city assessor and collector, but this was not allowed by the Commission, for the reason that it was not believed proper that it should be included in the language of the franchise, which deals only with the insular government and the grantee; but it was understood that the insular treasurer would credit the city of Manila with its full 2 per cent of its gross earnings within the limits of the city. The company is under the obligation of being fully equipped and ready to operate, within eighteen months from the date of the granting of the franchise, 1,000 telephones in the city of Manila, and a deposit of ₱50,000 or negotiable bonds or other approved securities was exacted as a guaranty. These conditions have been practically fulfilled, and the new system is now in a fair way to successful operation. The old system was closed for business on July 15, 1906, and the work of the removal of the poles, wires, etc., has commenced. A large part of the lines of the new system is carried in cables and laid in cement conduits. The work is being watched with great interest, for the reason that this is the first experiment of the extensive use of underground conduits in the city of Manila. The company has been somewhat embarrassed by the accumulation of surface water in the manholes and also in the joints of the conduits; but the limited experience apparently demonstrates the success of this method of construction. If extended operation develops entire satisfaction, it is the intention of the board to require a conduit construction for electrical transmission wherever the same is feasible. Arrangements have been made for the joint use of the city poles carrying the wires of the fire and police alarm system. A fixed tariff has been adopted for the rental of space on the poles, and in this way the city derives a small revenue, which goes to the maintenance of the poles and equipment; and, at the same time, the streets over which the new telephone lines are constructed are relieved of a number of unsightly obstructions. This is an important feature in Manila, owing to the narrowness and crookedness of the streets, and the overhanging balconies which project beyond the street line in many places.

REFORM OF THE PUBLIC LIGHTING SYSTEM.

On May 3, 1906, the committee on electrical illumination and installation presented a plan for the reform of the public lighting system, which has received the close study of the municipal and advisory boards and has been approved in part. This plan was described in detail and illustrated by a map of the city, showing the location of all poles and lights, as well as the proposed location of extensions. It was prepared by a committee composed of the city electrician, superintendent of buildings, and the committee on electrical installation and illumination. Owing to the peculiar conditions surrounding the implantation of civil government under the new charter of the city of Manila the public lighting system necessarily has been more or less of a patchwork job. To the lights which were found in the streets at the time of the American occupation additions have been made from time to time in many parts of the city wherever urgently necessary to the extent warranted by the limit of available appropriation. The original lighting was supplied under contract by La Electricista, and consisted of arc and incandescent lights. The incandescent lights have never been satisfactory, and as far as possible they have been eliminated and substituted by the arcs. The franchise of the Manila Electric Railroad and Light Company to construct, maintain, and operate an electric light, heat, and power system in the city of Manila and its suburbs was granted on March 24, 1903, and this company assumed the existing contracts of La Electricista with the city. The Manila Electric Railroad and Light Company has diligently prosecuted the work of improving the public lighting system and has substantially cooperated with the police and fire departments in the repair of old lines and in the renewal of unsatisfactory or deteriorated lights. In order to correct faulty lights and interruption, the police department is required to promptly report over the alarm system all lights burning dimly or extinguished and all breaks in wires and fixtures. In this way every section of the city is constantly under observation, and any irregularities are at once reported to the police headquarters. These in turn are reported to the contracting company, and in almost every case repairs and renewals are made in a prompt and satisfactory manner. This system of correction is giving excellent results. A large part of the old system has been rebuilt, and during the last few months new lines have been constructed and fed from the new power station, thus gradually reducing La Electricista service, which it is proposed to ultimately suppress. The system to-day is vastly superior to what it has been in any other year since the American occupation. The total number of incandescent lights of the street-lighting system paid for from city revenues is 936, at a contract price of ₱27.27 per annum per light, and 302 arc lights of 2,000 candlepower, exclusive of the harbor lights, matadero, and other interior lights, as a contract price of ₱196.36 per annum per light. The total cost of the public lighting system, exterior and interior, for the fiscal year 1906 was ₱108,208.98, which sum, in view of the service rendered, is believed to be cheaper than any other American city of approximately the same population and area.

After a carefully observed experiment of 50 inclosed arcs, which were installed in February, 1906, in the districts of Paco, Malate, and Ermita, this new inclosed arc was adopted by the municipal board as the type for future extensions in the public lighting system.

The plan for the reform contemplates the elimination of all incandescent street lights. The present annual cost of this class of light, consisting of 936 lamps, paid for from city revenues, is ₱25,524.72. As rapidly as possible the incandescent lights will be suppressed and the arcs substituted therefor up to the limit of the appropriation. If the Commission approves the amount fixed in the estimate of the municipal board, there will be, in addition to the sum formerly applied to the payment of incandescent lights, about ₱6,000, which may be used for such extensions as may be deemed most necessary. In view of the much reduced strength of the police force, every improvement in the lighting system will operate not only to the benefit of the public directly, but it will be of material aid in the maintenance of order.

As the work of the construction of the new water system progressed it was found necessary to install a line of telephone from the headwaters along the proposed pipe line to the city of Manila, with stations at the various camps and important points of the construction work. This line was erected and is being maintained by the Philippine Islands Telephone and Telegraph Company, under contract with the city, according to the terms of which the city assumes a monthly guaranty of not more than ₱135. This auxiliary line is a great convenience and saves much valuable time and long journeys.

NEW STATIONS REQUIRED.

It is again recommended that a suitable station house be secured in the Malate district. The value of residence property in this section of the city has been increased by many thousands of dollars during the past twelve months, and it is reasonable to anticipate that similar improvement will continue in the future. At the present time this is one of the choicest residential districts in the city. The nearest station is located at the intersection of Calles Nozaleda, Herran, and San Marcelino in the district of Paco, and with the most favorable conditions it requires from five to nine minutes for the apparatus to reach points in the district of Malate. Moreover, the Paco fire station is not equipped with a truck company, and if apparatus of this nature is necessary it must be brought from Tanduay, which is on the other side of the river. Arrangements have been made for the use of the old car stable buildings of the Manila Electric Railroad and Light Company, which are erected on city property held under a long lease, on the bay shore opposite Plaza Malate. A section of the building can be fitted up for station purposes at a cost of approximately ₱500. There is a good exit on a broad street and the location is central. A chemical engine could be established at this point which would be of great value, as an ordinary fire could be held under control until the arrival of the Paco apparatus, and in many cases the prompt use of the chemical engine might be sufficient to extinguish the fire. As the city is not in a position to purchase new apparatus, this engine could be diverted from one of the other stations. According to the estimates submitted to the Commission, the department is allowed so small a margin that it will be impossible to expend even the sum of ₱500 on this much-needed improvement during the coming year. Fortunately, the fire losses in Ermita and Malate have been very small, but as the great majority of houses are constructed of imported soft woods and there is very little stone or native hard wood used, the danger from fire is much increased.

In order that Santa Mesa Heights may be properly protected, it will be necessary to establish a station in the vicinity of the Rotonda, equipped with an engine company. The nearest station to Santa Mesa Heights is located in Tanduay at a distance of about 2 miles. The high ground is very desirable for residential purposes, and many houses have been constructed during the last two or three years in which imported soft woods have been extensively used. It will also be necessary to materially improve the water system, as there is a great scarcity of fire hydrants. Unfortunately, several fires have occurred on the Heights, and in a majority the residences were almost totally destroyed.

ADDITIONAL EQUIPMENT REQUIRED.

For the proper equipment of the department it will be necessary to purchase six more horses to replace unserviceable animals and those which are at present hired from the department of sanitation and transportation; also 1,500 feet of 2½-inch fire hose and 600 feet of chemical hose, and other general supplies enumerated in the detailed estimate.

DISCIPLINE.

When the present committee on fire assumed the duties of the position, in November, 1905, the discipline of the department was found in bad shape. The chief was absent on accrued leave after several years' continuous service, and things seemed to be running without proper management or supervision, both on the part of the officers of the department as well as the municipal board. There were many dissensions among the men, disobedience of orders was common, in some cases amounting to insubordination, and there was at least one case of open defiance of authority. The acting chief was apparently doing his best to maintain order, but his increased duties in electrical matters prevented him from assuming that active control of all details of the fire-fighting service which is always necessary to insure efficient organization. Measures were at once inaugurated by the new committee to improve conditions, the acting chief was energetically and consistently backed up in his work, and offenders were promptly called to account. On the return of the chief from his accrued leave every assistance was given him in handling the situation, and he took active control, with the result that conditions rapidly improved. A few punishments and the more rigid management served to bring about the desired results, and at the present time the discipline and general efficiency of the department are equally good, if not better, than during any period since its organization.

GENERAL OPERATIONS.

The department responded to 124 alarms during the last fiscal year, which is a decrease of 7 over the year 1905. All alarms, with the exception of one or two, were received with promptness over the fire-alarm system, which has been kept in perfect working order by the city electrician's force, and the quick response and efficient work of the department have reduced the losses to a minimum. A comparison of the losses for the past four years shows a steady reduction, the credit for which must be largely attributed to the increased efficiency and better equipment of the department. The following table is self-explanatory:

Losses for—

1903	₱1, 670, 650. 00
1904	468, 911. 00
1905	135, 921. 00
1906	76, 192. 90

The loss for 1906 is divided as follows:

Buildings	₱50, 175. 50
Contents	26, 017. 40

The total insurance on property affected by fire during fiscal year 1906, according to the records of the fire department, amounts to ₱692,237 on buildings and ₱853,620 on contents.

The total value of all buildings in the city subject to taxation, according to the records of the city assessor and collector, is ₱35,101,983. The approximate value of all buildings erected during the last fiscal year, plus repairs on old buildings, is ₱2,600,000, which therefore represents the approximate increase in the value of improvements subject to taxation, disregarding the element of one year of deterioration of all old buildings. The total loss due to fire on buildings during the same period was ₱50,175.50, or approximately one-seventh of 1 per cent. According to the annual report of the fiscal year 1905, the damage from fire was slightly less than one-fifth of 1 per cent.

Act No. 1421 appropriated for the fiscal year for—

Salaries and wages	₱237, 000. 00
Contingent expenses	60, 450. 00
Total	297, 450. 00

The expenditures were as follows:

Salaries and wages	₱238, 739. 74
Contingent expenses	56, 069. 89
Total	294, 809. 63

The above statement shows a decrease in expenditures of ₱22,757.54 over the previous year. This favorable reduction in the cost of operation and maintenance of the department has been accomplished without any loss in efficiency and is largely due to the elimination of nonrecurring expenses chiefly in the purchase of equipment and in the extension of the fire and police alarm systems.

It is expected that the funds required for the purchase of expendable supplies, repairs, and maintenance will increase as the equipment deteriorates with service. Most of the apparatus was purchased during 1902 and 1903, and the constant care which has been exercised by the engineers and officers in charge has served to keep the machinery and vehicles in such condition that very little heavy repair work was necessary, despite the fact that all of this class of equipment goes to pieces very rapidly in tropical climate. During the past year a great part of the repairs to apparatus was executed by the engineers of the department under the supervision of the chief engineer, and many improvements, minor alterations, painting, etc., have been accomplished by the regular firemen. This has resulted in a material saving to the city.

INSPECTIONS.

The usual inspections of the various districts of the city have been performed by the proper officers of each station, and the fire hydrants have been examined each month and tested by opening the plugs and flushing out the valves. Until January, 1906, the general inspection was made by the commanding officers of the stations of all stores, tiendas, and warehouses, and, in this way, the storage of combustibles and explosives was regulated; but since January the subdeputy chief of the department, who was appointed temporarily, performed these monthly inspections in all districts of the city. All powder and high explosives have been stored in San Juan del Monte magazine, and the regulations governing transportation for such materials have been carefully observed. Three hundred and twenty storage and 226 transportation permits were issued during the year. All fireworks are stored outside of the business districts and all large amount of petroleum, gasoline, calcium carbide, etc., are isolated in the outlying districts. This rigid inspection system largely accounts for the small number of conflagrations and the small area covered by them. All ordinances concerning the fire department have been strictly enforced. Owing to the varied nature of the performances given at the numerous cinematograph shows, such places have been classed as theaters and the owners have been required to furnish fire protection in conformity with section 2 of ordinance No. 40. All the engines of the department were tested monthly and kept in good condition, and the hose has been tested up to 300 pounds.

The cooperation of the police with this department is substantial and effective and in all cases the firemen have had a free field in fighting fires.

ELECTRICAL WORK.

Twenty-one new fire-alarm boxes were installed, bringing the total now in use up to 153 street alarms. Two auxiliary fire-alarm systems installed in the custom-house and the government laboratories were connected to the city system. Extensions were made from Calle Peñafrancia and Real in Paco to the military road at Santa Ana and along Calle Peñafrancia four blocks toward Pandacan; from Calle Herran along Calle H to San Andres; from Calle E along Isaac Peral to San Jose; from Calle Misericordia along Obando to Espeleta; from Paz (Santa Ana) along San Rafael to the water main; Calle Pavia to the Cotton Mills; Calle Soledad to Barraca; Magdalena to O'Donnell; Azcarraga along San Jose to Soler; and other short lines have been built from Lardizabal, Singalong, Carriedo, Principe, Magdalena, Aceiteros, and Soledad.

The police alarm has given perfect satisfaction in constant operation on a three and five minute schedule. Sixty-two police boxes were installed, and the extensions covered a large portion of the outlying districts of the city. Several portions of the police and fire alarm circuits were rebuilt and 364 50-foot poles were set. All the shorter poles which were taken out of the interior of the city, where a greater height is required, were reset in the outlying districts. The entire construction of both systems is now standardized and in first-class condition. Nine poles were broken by the typhoons, but they were cut to 35 and 40 foot lengths and used on the suburban extensions.

The change in the public and private lighting current from 110 to 220 volts has materially increased the inspection duties of this branch of the department. About 350 installations yet remain to be remodeled to the 220-volt current; 2,847 permits were issued for remodeling and for new installations, and 2,427 for certificates of inspection. Between July 1, 1905, and May 15, 1906, ₱7,008.05 were collected by the city electrician and deposited. On May 16, 1906, the collection work was transferred from the city electrician to the city assessor and collector, thus relieving the former of this money accountability. The fees of inspection collected by the city assessor and collector up to June 30, 1906, amounted to ₱859.45. The total receipts for the year show an increase of ₱4,068.20 over the last fiscal year.

During the year 1,628 telephone lines fell on the street, and there were 96 calls to remove hot wires of the telephone and electric light companies. This large number of fallen wires, which are now being removed from the streets, is due principally to the faulty construction of the Manila Telephone Company, the said company having been merged with the Philippine Islands Telephone and Telegraph Company. The usual repairs were made to all electric appliances belonging to the city, including the remodeling and installation of lights, fans, bells, etc.

GENERAL OBSERVATIONS.

An extended study has been made of a plan for lighting the Luneta. At the present time the arc lights are supplied from La Electricista, and therefore the high poles of the old construction have been retained. The illumination is fairly satisfactory, but unsightly and not at all suited to a public show place of this kind. As soon as the revenues will permit, the new inclosed arc will be substituted, mounted on shorter and more ornamental fixtures. It may be possible to reduce the number of lamps, or at least to reduce the candlepower. The new light is stronger and more satisfactory than the old. Being nearer the ground it is believed the change will be a material improvement and in harmony with the surroundings.

The contract entered into by the former government of the city of Manila, which has been continued by the new municipality and which does not expire for several years, provides that the lights in the public places shall be burned for twelve hours each night of the year under an annual tariff. Thus no modification in price could be secured by a reduction in the hours of operation. However, it is believed that satisfactory modifications may be adopted which will permit of the introduction of the Luneta system. The advisability of such a modification is a matter for serious consideration.

It has been noted with much satisfaction that the firemen, especially the Filipinos, are taking more pride in their personal appearance. There has been an increase in the number of requests received from probational members to wear the uniform, which is a privilege only credited to those who can obtain the recommendation of their commanding officers. A better class of men of both grades is seeking employment, and there has been no difficulty in securing good men to fill vacancies. The Filipino firemen in particular render uninterrupted service, and they value their position very highly. The constant training under experienced American officers is entirely satisfactory, and many second-class firemen are exceedingly efficient, and when operating under the direction of officers they perform their duties in a way which promises well for the future. The second-class men have learned to use their heads and to study the methods of attacking a fire, and those who have had two or three years' experience are less liable to confusion or to expose themselves to unnecessary danger or to lose time in useless activity. All the men who resigned had better positions in view, and several of the first-class men have returned to the United States for the purpose of going into business. Wherever possible these vacancies have been filled by promotions from the second class.

Owing to the graduated scale of salaries under the system of longevity pay for engineers and firemen, the maximum to be paid to the present force will not be reached, except in a few cases, until the fiscal year 1909. At the time the estimates were under consideration by the municipal board and there was a pressing need for rigid economy it was decided to suspend longevity pay in this department, with the exception of six of the most meritorious cases, during the fiscal year 1907. Subsequent investigation leads to a consideration of the advisability of this act. The number of men affected by the increase of pay, due to length of satisfactory service, is 60, and the additional amount of money which would be required to pay the scale of increase, provided that every man eligible by reason of length of service should receive his additional salary, does not exceed ₱4,385.28. Undoubtedly several members of the department would not be eligible, owing to unsatisfactory service or punishments imposed, and therefore this sum can safely be reduced. While this longevity increase is not a vested right, nevertheless the men have come to consider it their just reward for faithful and satisfactory service, and the wisdom of enforcing this small economy is a question for consideration at the time the estimates are under discussion before the Commission.

The firemens' relief association has been satisfactorily conducted by officers elected by the men, and valuable assistance has been given in several worthy cases.

In the annual report of last year it is noted that all stations used by the department belonged to the city. This should be corrected, for the reason that Intramuros station, No. 4, is claimed by the insular government and is occupied under a temporary agreement with the city.

DEPARTMENT OF ASSESSMENTS AND COLLECTIONS.

Under and by virtue of act No. 1407 the department of assessments and collections of the city of Manila was merged with the bureau of internal revenue January 1, 1906, and the collector of internal revenue became ex officio city assessor and collector. The reorganization committee recommended the change on the ground of economy, representing to the Commission that a considerable saving to the city would be effected by such a consolidation. That the committee were sincere in their representation and recommendation we will not question, but it was nevertheless a most unnatural and ill-advised scheme and so far has not resulted in any material saving to the city; nor have the revenues been more satisfactorily collected, while the city has been deprived of one of its principal attributes, that of immediately directing the collection of its own revenues.

The department was one of the largest of the city departments, and in the States would have been divided into at least four distinct public offices. The board already regrets its action in acquiescing to the proposition and believes now that the scheme should have been thwarted.

By the consolidation the city was deprived of an annual revenue of nearly ₱5,000 from rent of a portion of the building known as 149 Calle Anloague and now occupied by the consolidated offices in addition to the old quarters.

For your further information relating to the work of the department of assessments and collections, we quote the following from the city assessor and collector's annual report to the board:

Real-estate tax.—In the last report of the city assessor and collector covering the fiscal year ended June 30, 1905, it was stated that the assessment rolls were in better shape than at any previous time. During the fiscal year ended June 30, 1906, surveys of the various blocks were continued, and the further perfection of the assessment rolls has made satisfactory progress. It will take further time to complete this work as originally outlined.

In accordance with the provisions of the Manila charter a new general assessment of all the real property in the city of Manila was made for the year 1906. The work of making this assessment has been conducted for the past two years by the city assessor and collector and his force of employees, and important data relative to the rentals, sales of property, etc., in all parts of the city has been collected and compiled. The officers and employees charged with making this assessment have had several years' experience, and have had for reference two former assessments, one made by the city assessor and collector in 1901–2 and the other by the board of tax revision in 1903. All new streets, blocks, and lots laid off, as well as new buildings erected or improvements made to existing properties, are at once platted by employees of the division of real-estate assessments in this office. The maps already compiled are even now found to be of great assistance to property owners and are a constant source of valuable and reliable information to would-be purchasers of city property. As the time passes and further data, now being gathered by the assessors, is recorded, the value of these maps will increase. All of this data is open to inspection by the public.

Slight errors and irregularities have been discovered in the two former assessments. It is believed that the board of tax revision has eliminated most of the errors found in the preceding assessments. The best evidence that city property is now assessed at approximately its true value and that the assessment is, all things considered, an equitable one, is found in the fact that of the 15,780 different pieces of property assessed, and now appearing on the tax rolls, aggregating in value ₱80,525,235, appeals to the board of tax revision from the valuations fixed by the city assessor and collector were taken only in the case of 298 parcels, aggregating in value ₱6,868,077. The board of tax revision took action favorable to the applicants in only 34 cases out of the 298 appealed.

The original assessed value of all city property for 1905 was ₱77,754,354. To this there were added further properties worth ₱176,449, discovered after the completion of the original rolls, making a final total assessment for 1905 of ₱77,930,803. For the purpose of making a comparison between the figures for that year and for the year 1906, the totals must be reduced by (1) the value of all buildings destroyed during 1905, ₱319,694; (2) cancellations made on account of erroneous and double assessments, ₱152,474, and (3) all additional exemptions granted during 1905, ₱502,752, making a total reduction of ₱974,920, and leaving for comparative purposes ₱76,955,883 as the assessment of 1905.

The 1906 assessment amounts to ₱80,525,235, from which, for comparative purposes, there must be deducted the value of new buildings erected since the 1905 assessment was completed, equal to ₱2,682,606. This leaves the 1906 valuation at ₱77,842,629, or an increase over the 1905 assessment of ₱886,746. This increase is equal to but a fraction over 1 per cent and is not the result of a general raising of values throughout the city inasmuch as some valuations have been reduced and others have been increased. Equitable valuation and not forced increases has been the watchword.

The following statement shows the comparative valuation of real estate by districts as of record in the assessment rolls at the beginning of each year:

District.	1903.	1904.	1905.	1906.
Intramuros	₱7,229,404	₱5,022,728	₱5,053,954	₱4,896,697
Binondo	18,826,550	18,576,184	18,779,422	18,671,529
San Nicolas	12,662,338	13,027,050	13,249,290	13,272,457
Santa Cruz	7,410,904	7,701,846	7,992,546	8,578,001
Quiapo	4,254,200	4,411,414	4,600,292	4,822,367
San Miguel	4,687,890	4,962,362	5,006,108	4,976,038
Sampaloc	3,165,798	3,596,696	3,827,772	4,061,036
San Lazaro estate	329,940	458,170	538,066	579,404
Tondo	3,558,448	3,965,116	4,156,914	4,673,891
Ermita	5,689,520	6,271,494	6,708,748	7,155,925
Malate	2,602,030	2,752,768	3,037,502	3,569,165
Paco	2,647,850	2,898,160	3,546,338	3,982,540
Pandacan	342,806	358,796	431,016	440,531
Santa Ana	799,468	812,752	826,386	845,654
Total	74,207,154	74,815,536	77,754,354	80,525,235

The following shows the comparative value, by districts, of new buildings erected during each year:

District.	1903.	1904.	1905.	Total.
Intramuros	₱106,990	₱87,146	₱29,200	₱223,336
Binondo	384,390	250,676	190,272	825,338
San Nicolas	379,768	353,912	248,900	982,580
Santa Cruz	312,330	302,520	207,268	822,118
Quiapo	190,442	196,516	249,738	636,696
San Miguel	286,944	141,356	56,290	484,590
Sampaloc	446,422	273,670	306,650	1,026,742
San Lazaro estate	128,230	79,158	110,764	318,152
Tondo	392,622	209,656	223,398	825,676
Ermita	682,394	522,338	587,526	1,792,258
Malate	191,610	332,924	194,642	719,176
Paco	250,642	653,026	235,744	1,139,412
Pandacan	16,532	74,788	9,970	101,290
Santa Ana	15,004	12,160	32,244	59,408
Total	3,784,320	3,489,846	2,682,606	9,956,772

REAL-ESTATE TAX COLLECTIONS.

During the entire fiscal year ended June 30, 1906, taxes, penalties, and interest have been collected in the sum of ₱1,208,265.31, being current and back taxes, distributed as follows:

1901	₱192.38	1905	₱470,404.37
1902	10,638.66	1906	686,119.29
1903	7,911.92		
1904	32,998.69	Total	1,208,265.31

Matadero.—Collections at the matadero have fallen short of the estimate made by the city assessor and collector in his last report by about ₱15,000 and is due to the scarcity of cattle available for slaughter. The islands furnish very few cattle for this purpose, and until just recently Hongkong was the only market from which importations of cattle were received. Several impertations have recently been received from Saigon, and it is believed that with this competition the price of cattle will be reduced and that the collections will be somewhat larger during the fiscal year ending June 30, 1907, that they were during 1906. The expense of operating the matadero has been reduced by about ₱2,000 as compared with 1905.[a]

Public markets.—There has been no change either in the number or location of the public markets since the date of the last annual report of the city assessor and collector. Of the nine public markets, losses in the collections for the fiscal year 1906, as compared with the collections for the fiscal year 1905, are shown in the case of seven, as follows:

Divisoria	₱10,230.80	Herran	₱54.82
Quinta	10,808.96	Anda	1,192.11
Arranque	6,461.07	Santa Ana	202.92
Sampaloc	481.55		

Increase as follows are shown in the collections made in two of the markets:[b]

Gagalangin	₱234.23
Pandacan	453.62

The total market fees collected for the fiscal year 1906 amount to ₱269,430.88, as compared with ₱304,916.34 collected during the fiscal year 1905, resulting in a loss of ₱35,485.46.

This loss is largely attributable to the suspension, by the municipal board, of collections at bay and estero landings.

Municipal licenses.—Under the provisions of existing ordinances only the following occupations, trades, professions, and objects are subject to the payment of municipal licenses: Dealers in spirituous, vinous, and fermented liquors, peddlers (excepting those who sell only native vegetables, fruits, or foods personally carried by themselves), auctioneers, plumbers, hotels, restaurants, lodging houses, livery stables, race tracks, public vehicles, and dogs.

Practically all occupations, trades, and professions were subject to the payment of municipal license taxes during the first half of the fiscal year ended June 30, 1905. On January 1, 1905, the municipal board's powers to impose license taxes were greatly curtailed by the provisions of act No. 1189 of the Philippine Commission. This largely accounts for the falling off of over ₱70,000 in the collections from this source during the fiscal year ended June 30, 1906, as compared with the fiscal year ended June 30, 1905.

Liquor licenses.—Collections from the sale of liquor licenses during the fiscal year 1906 were ₱184,278.64, as compared with ₱201,324.86 during the fiscal year 1905, which shows a loss of ₱17,046.22.[c]

Business licenses.—There are only eight occupations, trades, or professions now subject to the payment of municipal business licenses, hence the relatively small collection of only ₱6,770.57 during the last fiscal year as compared with ₱37,518.72 collected under this head during the fiscal year 1905.

Public-vehicle licenses.—The collection from this source aggregated ₱13,621.10, or only ₱578.45 less than was collected for the year preceding. From this it would appear that either the electric railway is making very little inroad on the traffic of public vehicles or that the people of Manila are more on the go now than they were before the street cars were installed. There is a constant increase from month to month in the number of vehicle licenses issued. There were licensed during the year 2,079 one-horse rigs, 63 two-horse rigs, and 792 carabao carts; 187 licenses were transferred and 404 duplicates issued.

The quality of the public vehicles has been somewhat improved, as it is the policy of this office to license only such rigs as are in good condition and drawn by healthy looking animals.

Entertainment and peddlers' licenses.—Receipts under this head for the fiscal year 1906 amount to ₱8,740 as compared with ₱25,126.80 collected during the fiscal year 1905, resulting in a loss of ₱16,386.80. This decrease is due to the repeal of certain municipal licenses taxes by the provisions of acts

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[a] Statement showing the number of animals slaughtered, the weights in kilograms, and the fees collected is on file in the War Department.

[b] Statement showing the collections at each market during the fiscal year 1906 is on file in the War Department.

[c] Statement of liquor licenses issued and transferred during the fiscal years 1905 and 1906 is on file in the War Department.

Nos. 1189 and 1338 of the Philippine Commission. Act No. 1189 repealed the provisions of law for issuing licenses to theaters and other places of amusement, and Act No. 1338 so amended the license ordinance as to exempt peddlers selling native vegetables, fruits, and foods, carried by themselves, from the payment of a municipal license tax. At present the only concern subject to a municipal entertainment license is the San Lazaro racing club, which pays an annual license tax of ₱200 and a fee of ₱10 for each day that races are run. Races were run on one hundred and fourteen days during the year, which with the ₱200 annual tax, makes the total annual taxes paid by this club ₱1,340.

Registration of live stock.—This is the only Spanish law imposing municipal taxes that has not been repealed. It is not known whether copies of this law are extant; a copy has never been in the possession of this office. Collections are made by virtue of an order of the provost-marshal-general, which, by the provisions of the Manila charter, was continued in force after the establishment of civil government. Under the existing schedule of charges the fees are so small that the collections hardly pay the expense of enforcing this law. It is impracticable to require proof of ownership as is done throughout the provinces under the provisions of act No. 1147. It is recommended that the provisions of act No. 1147 be made applicable to Manila. During the year covered by this report 2,925 animals have been registered, at a fee of 20 centavos each, and 2,008 transfers of ownership have been recorded, at a fee of 10 centavos each, making a total collection of ₱785.80, as against ₱814.75 for the year 1905.

Manila Electric Railroad and Light Company; franchise tax.—By the provisions of its charter the Manila Electric Railroad and Light Company pays to the city of Manila 2½ per cent of its gross earnings from fares collected, tickets sold, and electric light and power sold. In consideration of the payment of this franchise tax the company is exempted from the payment of all other taxes, except the real estate tax. The sum of ₱28,662.85 was collected from this company during the fiscal year 1906, representing twelve monthly payments. A comparison with the collections for the fiscal year 1905 would be valueless, as the company only began operations in April, 1905.

Statement of collections for 1906 and estimate of collections for 1907, by city assessor and collector.

Source of revenue.	Receipts fiscal year 1906.	Estimated receipts for fiscal year 1907.
Land tax	₱1,208,265.31	₱1,250,000.00
Industrial tax	1,191.81	....
Certificates of registration (old law)	846.00	....
Stamp sales (old law)	....	....
Matadero tax	160,049.25	160,000.00
Market tax	269,430.88	260,000.00
Licenses	217,958.16	240,000.00
Live-stock registration	785.80	750.00
Vehicle tax	....	....
Vehicle equipment	1,231.30	1,000.00
Rents, city property	18,730.29	20,000.00
Municipal court fines	68,500.77	70,000.00
Pail system	59,327.16	70,000.00
Vault cleaning	38,691.85	30,000.00
Weights and measures	6,410.40	900.00
Water rents	210,738.69	220,000.00
Building permits	17,958.90	20,000.00
Boiler inspections	1,070.00	1,200.00
Board of health	15,048.00	15,000.00
Justice of peace fees	6,757.90	6,000.00
Sheriff's fees	13,689.36	12,000.00
City attorney	192.26	400.00
City electrician	7,868.70	8,000.00
Secretary municipal board	69.00	50.00
Pound receipts	4,077.00	4,000.00
Miscellaneous	13,811.70	10,000.00
Sales of city land	2,644.30	50,000.00
Cementerio del Norte	13,425 09	7,500.00
Franchise tax (Manila Electric Railroad and Light Company)	28,662 85	34,000.00
Internal-revenue dividend	74,876.93	205,000.00
Transportation of meat	3,470.74	8,500.00
Total	2,465,780.40	2,704,300.00

Expenses.—The actual net expense during the year for the collection of the city revenues, which was borne wholly by the city of Manila, is as follows:

Salaries and wages	₱89, 011. 04
Contingent expenses	15, 467. 15
Total	104, 478. 19

Or a fraction over 4.2 per cent of the total collections.

Markets and slaughterhouse.—The receipts from markets have suffered considerable decrease—from ₱304,915.98 in 1905 to ₱269,430.88 during this last fiscal year. The difference of ₱35,485.10 is due partly to the resolution referred to by the law department in this report, suppressing the collections that were formerly made at the wharves, shores, and other places—which collections were included in the items denominated "Tetuan, bahia, and estero"—and partly to the reduction in the city's population observed during the last two years and brought about by the great facilities of transportation afforded by the electric tramway and the railroad branch to Antipolo.

The new Sampaloc market will be opened to the public in July next, when one of its sections will have been completed.

The receipts from the slaughterhouse have likewise shown a decrease of ₱9,303.75 as compared with the revenue derived therefrom in the fiscal year 1905, due partially to the fact that the people are not now so much prejudiced against Australian refrigerated meats sold at a cheaper price than fresh beef—this latter obtained wholly from China. It is to be expected that this competition will prove advantageous to the consumers.

The following table shows the receipts from the various city markets and the total incomes as compared with the fiscal year 1905. The collection expenses represent 7 per cent of the market and 6 per cent of the slaughterhouse receipts.

The uselessness of the Anda market calls for its closure, and likewise some reforms in the operation of the smaller markets, in order to reduce the expenses of collection and maintenance to 6 per cent.

In former years the transportation of meats from the slaughterhouse to the markets was done by a contractor, who collected daily from the slaughterers for this service at the rate of 7½ to 12 centavos per quarter. At the termination of the contract in February this service was assumed by the department of transportation and sanitation, at the rate of 7 centavos per quarter, having produced an income of ₱3,470.74, against an outlay of ₱2,642, affording in five months a profit of ₱827.14 and greater efficiency in the service.[a]

CITY SCHOOLS.

EXPENSES OF CITY SCHOOLS.

The city's relations with the educational branch are purely of an economic nature, and we are therefore to consider the schools from that point of view.

Section 59 of the Manila charter sets apart 25 per cent of the total collection of the tax on real property for defraying the expenses of the city public schools. In the last fiscal year the total revenue from that tax was estimated at ₱1,152,580; the approximated amount to be devoted, therefore, to this obligation was ₱288,145. Act No. 1421 appropriated for expenses of city schools the sum of ₱264,253. To this sum must be added the expense incurred for the lighting, care, rentals, and maintenance of the buildings and the force employed for their care and cleaning, so that the amount expended by the city for this service far exceeds the above-mentioned sum of ₱288,145.

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[a] Statement on file in War Department.

ATTENDANCE AT THE SCHOOLS.

The number of children who attend the schools is daily increasing, as may be seen in the following statement:

School enrollment during the month of June, 1902–1906.

Month and year.	Day schools.	Night schools.
June, 1902	2,244	1,556
June, 1903	3,046	2,626
June, 1904	5,767	5,043
June, 1905	7,803	5,334
June, 1906	8,311	(a)

[a] The night-school funds for the fiscal year 1906 having been exhausted, it was not possible to open the night schools in June. They were opened on July 9. The attendance of the same for July was 1,405.

The yearly increase of attendance of the city schools renders necessary a greater number of schoolhouses and greatly increases the expense of their rental and maintenance. It is to be regretted that the city resources are so limited as not to permit a much larger sum to be devoted to this obligation.

SCHOOL DISTRICTS.

To the five districts existing during the expired year, one other has been added at the begnning of the present fiscal term, as follows:

First district: Santa Ana, Pandacan (Beata, Peñafrancia), Paco (Santibañes, Tanpue, Looban, Bangbang, Sinalong).

Second district: Malate (except subdistrict of Singalong), Ermita (Concepcion), Intramuros.

Third district: San Miguel (Uli-Uli), Sampaloc (Santa Mesa, Santol, Mangahan, San Roque, Balic-Balic, San Isidor, Calubcub, Sulucan).

Fourth district: Quiapo, Santa Cruz (Dulumbayan, San Lazaro).

Fifth district: Binondo (Meisic, Trozo).

Sixth district: San Nicolas, Tondo (Tutuban, Palumpung, Tayuman, Gagalangin, Lico).

SCHOOLHOUSES.[a]

Regarding this matter, the following comments are made by Mr. C. H. Magee, acting superintendent of city schools, in the report above referred to:

"A number of undesirable buildings have been vacated during the past year and better buildings for school purposes secured.

"Cuartel Meisic, which was formerly occupied by the military authorities, has been secured for school purposes. When these buildings have been repaired and adapted for school purposes they will accommodate about 2,500 pupils. The following schools will be transferred to Cuartel Meisic: Tondo primary school, 569 Calle Lemery; Tondo intermediate school, 568 Calle Lemery; Trozo boys' school, 232 Calle Diaz; and the Trozo girl's school, 59 Calle Latorre. The school formerly located at 129 Calle Aceiteros was moved to Cuartel Meisic at the opening of the present school year. This will result in the consolidation of five schools and in a saving of about ₱12,000 in rental.

"The following schools are now quartered provisionally in Meisic: The Aceiteros primary school, one kindergarten, the domestic science laboratory, and the school of telegraphy.

"Negotiations have been completed for securing from the military authorities the quartermaster shops in San Nicolas. It is proposed to transfer the school now located at 177 Calle Madrid, San Nicolas, to the quartermaster shop. This will result in a saving of ₱3,600 in rental, and will provide accommodations for about 200 more pupils.

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[a] Statement of the number, location, and monthly rental of the city schoolhouses, according to the report of Mr. C. H. Magee, acting superintendent of city schools, is on file in the War Department.

"There is a possibility that the building now occupied by the Engineer Corps, Malecon Drive, will be turned over for school purposes. In that case it is proposed to transfer the third-grade pupils from the Intramuros primary school to this building."

Further on he recommends:

"The greatest need of the city schools is better buildings. The city at present owns four of the buildings now occupied by the public schools. Of these four buildings, one has been erected since American occupation, namely, the school of Gagalangin, costing some ₱2,500. The other buildings were erected during Spanish occupation. The best building is the one now occupied by the Manila high school, 172 Calle Victoria. Last year the city paid about ₱65,000 in rentals for school buildings. In place of paying out rental for school buildings from year to year the following plan is suggested: That the money now paid in rental be used to pay interest on an issue of bonds, the principal to be used to erect new buildings. The sum of ₱65,000 would pay the interest on 4 per cent bonds to the amount of ₱1,625,000. Allowing ₱100,000 as the cost of a building suitable for 1,000 children and ₱200,000 for the purchase of the necessary land, it would be possible to erect fourteen such buildings with the same annual expenditure. The type of building recommended is one similar to the building now occupied by the Manila high school, 172 Calle Victoria, Intramuros, modified to suit the present needs.

"It is recommended that one building of this type be erected in the present school year and that it be located in the district of Tondo. Tondo with its population of 40,000 does not possess a suitable building for school purposes either owned by the government or by private parties.

"It is recommended that an American school be erected in Paco, with accommodations for 400 students, including the kindergarten."

The scheme suggested by the acting superintendent, for the city to erect buildings the cost of which is to be met by means of a loan, is not possible. The charter of Manila does not empower its government to enter into such operations.

The liberal attitude of the insular government regarding this matter is shown by granting to the city the use of buildings which were formerly occupied by the War Department and which upon being evacuated by the military are turned over to the civil government. This leads to the hope that at no distant date and by this means the much-felt need of buildings for school purposes in Manila will in great measure have been supplied.[a]

DEPARTMENT OF SEWER AND WATERWORKS CONSTRUCTION.

The definite schemes for these works were approved, that for the water supply on June 20, 1905, and for the sewer system on July 22 of the same year.

Before the approval of these schemes the preparation of complicated preliminary studies became necessary in order to determine upon the most suitable system to be adopted in one and the other. (See annual reports for 1903 and 1904.)

WATER SUPPLY.

The scheme of the system of water supply, due to Mr. J. F. Case, chief engineer of this department, takes the water for Manila from the Mariquina River at a point situated in an extreme suburb of the town of San Mateo, about 16 miles above Santolan, the present intake of the present water-supply system. At the said initial point of this work, by means of a dam and its corresponding gates, a section of the river is to be converted into a reservoir of 2,000,000,000 gallons capacity, at an elevation of about 212 feet above sea level. One mile distant from the San Juan deposito, at a point situated about 112 feet above sea level, another reservoir of about 50,000,000 gallons will be built, from which the water will be distributed to the city, the present reservoir of 16,000,000 gallons capacity remaining as a reserve deposit.

From the dam to the distributing reservoir the water will flow by its own gravity, passing through iron pipes of 42 inches in diameter for a distance of 10½ miles, wherein the force of gravitation exacts strong, resistant piping, and through a cement-built tunnel for a distance of 4½ miles wherein the water will flow on the hydraulic gradient and no great resistance in the walls of the conduit is required. This tunnel section begins at the distributing reservoir and extends 4½ miles therefrom.

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[a] The number of teachers employed in the city schools, together with the salary drawn by each, is detailed in the table taken from the report of the acting superintendent, and is on file in the War Department.

The water from the distributing reservoir will be carried by means of the present system, plus the necessary increase, so that the most extreme suburbs of the city will be amply supplied.

This scheme is to be carried out by contracts for the construction of the work and for the supply of the necessary material, in three separate divisions which shall, respectively, comprise:

1. (*a*) Dam and heads works; (*b*) furnishing steel plates and rivets; (*c*) manufacturing and laying steel pipe; (*d*) tunnel and conduit; (*e*) reservoir and gatehouse works.
2. Works comprising storage reservoir above the dam, certain masonry bridges, culverts, etc.
3. The extension of the distribution system throughout the city; but the extent of the same can not be determined in advance, because it depends upon the remaining appropriation for the two previous sections.

On January 2, 1906, the day appointed for the opening of the bids, American companies exclusively presented bids, and the contracts for the above-mentioned sections were awarded as follows:

Item.	To whom awarded.	Amount of bid.
Construction of dam (*a*)	Matson, Lord & Belser Co	$241,510.25
Steel plates (*b*)	Henry H. Peabody & Co	99,900.31
Steel pipe (*c*)	Atlantic, Gulf and Pacific Co	281,935.00
Tunnel (*d*)	do	179,987.50
Reservoir (*e*)	Matson, Lord & Belser Co	222,477.70
Total		1,025,810.76

These works should be completed July 1, 1908. Their present status is as follows:

(*a*) Work was commenced in this section before any of the others, on July 20, and progress therein has been retarded, owing to the rainy season.

(*b*) Delivery of materials of this section has not yet begun.

(*c*) At the point of intersection of the Pasig and San Juan rivers the contracting company has established a steel-pipe factory.

(*d*) Work has likewise commenced in this section.

(*e*) Work has likewise commenced in this section.

The specifications and details of the work comprised in part 2 are already almost completed, but they will not be offered for bids until those of part 1 are very much more advanced.

The survey of the line of road and the tunnel through and whereon the piping is to be laid, as likewise of the other lands to complete the scheme for this work, has been very laborious and has occupied to a great extent the force of this department during the fiscal year just closed, owing to the needful measurements, the interviews with the owners of lands expropriated and others to be expropriated, and the many questions always arising when it is sought to acquire lands in localities where occupation appears to be the sole title alleged to prove ownership.

Upon contract with the Philippine Islands Telephone Company a telephone line has been laid, placing Manila in easy communication with these works by means of stations suitably located.

In order to secure assurance that the material to be used in the work of construction be of the kind and conditions exacted in the specifications, a contract has been entered into with the Pittsburg Testing Laboratory for the manufacturing inspection of said material.

SEWERAGE SYSTEM.

The sewerage-system scheme adopted is due to Mr. O. L. Ingalls, principal assistant engineer of the department, which scheme is devised solely to carry off sewage and the impure liquid matter from dwellings, factories, stables, etc. Rain water is not to be carried off by this sewerage system. This is to be accomplished by a general system of drainage entirely independent thereof.

The purpose of the sewerage scheme as outlined is to discharge all refuse matter into the harbor at a point situated opposite the mouth of the Pasig River, and at a distance of 6,500 feet from the shore, by means of a cast-iron force main 42 inches in diameter laid below the bed of the harbor and supported by a pile foundation suitably constructed. The discharge into the bay will be accomplished by means of powerful centrifugal pumps placed at the end of Azcarraga street in a pumping station constructed for the purpose. Five additional pumping stations similar to the one described, but with less powerful pumps, will be required to handle the sewage in other parts of the city. These pumping stations will be distributed so that three will be located on the north and three on the south side of the Pasig River. Those stations located on the north side, including the one already mentioned on Azcarraga street, will be located at the intersection of Paz and Arranque streets and also at Iris and Plaza de Santa Ana. Those stations proposed for the south side of the river will be located at the intersections of Nueva and Herran streets, Bagumbayan and Nozaleda streets, and Herran and Nozaleda streets.

All sewage collected on the south side of the river will be conveyed to the north side for discharge into the bay by means of a double 24-inch cast-iron pipe crossing the Pasig River under water. The scheme for the construction of the work and for the furnishing of all necessary materials will be carried out by two separate contracts, which shall comprise, respectively:

(1) The construction of approximately 52 miles of sewers, of which 7.5 miles will be composed of brick and concrete, ranging in size from 4.75 feet in diameter to 2 by 3 feet egg-shaped sewer, and laid at depths ranging from 12 to 18 feet below the surface; and 42 miles will be of terra-cotta pipe from 8 to 24 inches in diameter and laid at depths of from 5 to 16 feet.

In addition to this there will be one 42-inch cast-iron outfall pipe 6,500 feet in length, laid below the bed of the harbor on a pile foundation, besides one double line of 24-inch flexible-joint cast-iron pipe 650 feet in length crossing the Pasig River.

(2) The construction of the six pumping stations and also the furnishing of all pumps, engines, and other necessary equipment therefor.

The necessary plans and specifications for that portion of the work which consists in the furnishing of materials, laying of all pipes, and other described construction were submitted to the board for approval, and bids or proposals for doing the work were advertised on August 1, 1905, to be opened on January 12, 1906. On the opening of bids the Atlantic, Gulf and Pacific Company were found to be the lowest bidders, and contracted to do the work for $1,631,053.20. The contractors have chosen the main pumping station on Azcarraga street as the initial point for beginning work, at which point they have already completed about 200 linear feet of sewer. This work, in accordance with the terms of the contract, should be completed by July 1, 1909.

At least two years prior to the date calculated for the determination of the sewer contract bids will be asked for the construction of the six pumping stations above referred to, and also the furnishing of all necessary pumps, engines, and other machinery therefor.

Especial attention has been given to a study of this problem during the fiscal year just closed for the purpose of ascertaining the most desirable system of engines and pumps to be used in the various pumping stations, in order that the expense for operation and maintenance may always be kept at a minimum amount. A considerable time has also been given to designing a screen chamber and a system of sewage screens which are intended for the purpose of separating and removing all bulky or floating substances from the sewage, in order to prevent the clogging of the pumps or for hygienic reasons to prevent their becoming a nuisance in the waters of the bay.

Bids will be opened on September 12, 1906, for the furnishing of about 400 iron sewer gates and sluice gates, ranging in size from 8 to 20 inches in diameter, for use in the flushing and cleaning of the proposed system of sewers for the city. These gates will be introduced at all terminal manholes and at such other points along the longer lines of sewer as will be found necessary for maintaining the system at all times in a sanitary condition.

PROBABLE COST OF THE WORK.

It would seem opportune before treating this subject to call attention to the fact that the study and execution of all plans for a system of storm-water drains have likewise been intrusted to this department and that the expense therefor is to be charged against the $4,000,000 loan. This was agreed upon, but not without objection, for the reason that it was believed that the said $4,000,000 loan should be devoted exclusively to defraying the expense of the water-supply and sewerage system construction in accordance with the provisions found in act No. 1323, and that such a liberal interpretation of the act might prove to be cause for a lack of funds for the completion of these works.

The estimate of outlay compared with the income is as follows:

Income:	
Amount of the loan	$4,000,000
Premium at the rate of $95,625 per million	382,500
Total	4,382,500
Outlay:	
Expense incurred up to June 30, 1906	380,000
Amount of contract for the water system—	
Part 1	1,025,000
Part 2	165,000
Part 3	400,000
Amount of contract for the sewer system—	
Part 1	1,631,000
Part 2	370,000
Contingent funds	150,000
Customs duties on the materials to be imported	100,000
Cost of inspection and supervision	150,000
Total	4,371,000

Comparing the total income with the outlay a remainder of $11,500 is shown, which demonstrates a reasonable estimate of the cost of these works when completed.

STORM-WATER DRAINS.

As hereinbefore stated, this work is in charge of this department and consists of the establishment of a system of canalization, through which the storm water will run into the sewers, which in turn will empty it into the esteros or into the Pasig River. As the street levels in the city are so varied, the drains to be built will not be uniform. Some will be U-shaped, others of the horseshoe form, and still others round in their vertical section, to suit the peculiar features of the places wherein they are to be placed. The entire plan is not yet completed, but partially completed plans have already been made for the districts of Ermita, Malate, Santa Cruz, Tondo, Binondo, and Sampaloc.

Some of these sections are now being constructed, as may be seen by the following excerpt from the report of the chief engineer of this department:

" Plans and specifications were prepared and proposals invited for a drain 270 meters in length and 5 by 6 feet in section, running from the Malecon drive, near the Legaspi monument, through the proposed hotel site to the newly built bulkhead on the bay front. This work was built by the Atlantic, Gulf and Pacific Company, under contract, at a cost to the city of ₱29,000. Due to damage resulting from the pumping of mud by the Atlantic, Gulf and Pacific Company against this new work, it has not been accepted nor finally paid for.

" Contract for the construction of a storm-water drain on Calle Santa Monica, Ermita, with laterals on adjacent streets, was entered into with Salvador Farré, the city supplying certain of the materials necessary. The total amount paid to the contractor was approximately ₱11,000. This work was completed in strict conformity with the specifications and was in every way acceptable.

"A drain was also installed in Calle Soler, Santa Cruz, by Smith & Blossom, contractors, running from the Estero de Trozo to Calle Almansa, with laterals on Calle Misericordia and Calle Almansa. This work is not entirely complete, but will relieve and place in a comparatively sanitary condition a thickly settled district of approximately 30 acres."

It has been estimated that three years will be required in which to complete all sewer work.

The introduction of a sewerage system and an increased water supply for Manila will prove a lasting benefit from a hygienic point of view and will be a most important factor in the material progress and future growth of the city.

It is to be hoped also that these plans can be carried to completion at a cost not to exceed the estimate, which has been placed at $4,000,000, in which event it may be asserted that the expense incurred in making these improvements has been incomparably less than those incurred by most cities of an equal population in either Europe or America for improvements of a similar nature.

DEPARTMENT OF SANITATION AND TRANSPORTATION.

This department was created as of July 1, 1906, from a division of the department of engineering and public works, and embraces all sanitary work, street sprinkling, care of parks and public grounds and cemeteries, and all city transportation, also a large part of the transportation used by the insular government. Some time prior to the inauguration of this new department an arrangement was made between the insular government and the city whereby the city took over from the insular government all its light transportation, equipment, stables, and corral on Calle Cervantes at a cost of about ₱225,000, to be paid for in transportation service at certain tariff rates. A considearble part of this equipment was old and in poor condition, and in the year past much expense has been incurred in putting and keeping the vehicles in serviceable condition. That the arrangement was an exceedingly good one for the insular government no one can deny. At the tariff rate adopted by the committee and approved by the governor-general it was believed that the income from the service would result in some profit to the department, but notwithstanding the fact that the department has been economically and efficiently managed, the monthly statements have frequently shown a loss, and this without reckoning interest on the investment or deterioration and loss on stock, etc. The rate for service should be materially increased. The debt to the government for the purchase referred to has been reduced by about one-half.

Capt. J. C. Mehan, formerly city superintendent of parks, etc., was made chief of the department, and Mr. Fred M. James assistant chief.

For your further information relating to this department, we quote from the annual report of the acting chief, Mr. Fred M. James:

"From 1,100 to 1,400 employees were engaged in carrying on the operations of the department, the number required varying according to the needs of the service. By making payments for services upon a daily wage basis it was found possible to reduce the cost for such services to a much lower figure than would have been possible if a force sufficiently large to meet every requirement had been maintained throughout the year.

"Special attention was given to the use of supplies and materials, and every effort was made to reduce the cost to the department for equipment, tools, and expendable supplies to the lowest possible limit.

"Collections were made for services in connection with pail cleaning, vault cleaning, transportation, and the rent and sale of rights at the city cemeteries, amounting in all to ₱258,104.28. The following services were rendered by the department for the benefit of the public, for which no collections were made: Street cleaning, garbage collection, maintenance of crematories, public closets, pail and vault cleaning in city buildings, improvement and maintenance of parks and public grounds.

"*Street cleaning.*—The streets were swept at stated intervals varying from three times daily to twice weekly, according to their importance as business thoroughfares and the amount of traffic passing over them. The gutters were all scraped or flushed out and grass and weeds removed from the surface as often as was found necessary. The grass and weeds in vacant lots and along the city walls were removed from time to time, and all material collected which could be used for the purpose was dumped into the lowlands belonging to the city. Hand carts and dump carts were used in collecting the street refuse and conveying it to a proper dumping place.

"*Garbage collection.*—All house refuse, trade refuse, etc., was collected with carts and transported to the crematories, or, when the nature of the material would allow, to a regular dumping site and used for filling. Daily inspection was made of the beaches and the open sites around city markets, all material found at these places being collected by employees of this department and properly disposed of. Dead animals, too large to be placed in garbage receptacles, were collected by means of a wagon built for this service, and after being noted by the police department were cremated.

"*Collection of night soil.*—The pail conservancy system has been in service long enough to prove its value as a sanitary means of disposing of night soil where other means for its disposition are wanting, and forms no small part of the sanitary work of the city.

"As a protection to the water supply of the city 150 pails were placed at convenient points along the Mariquina River above the intake at the pumping station. These pails have been cleaned daily by employees of this department.

"From three to six odorless excavators have been in use every night during the past year, removing the contents of vaults from private residences and public buildings. It is not contemplated that this service in any way be reduced until the new sewer system has been completed, as it is the only means of removing night soil from many of the buildings supplied with modern sanitary appliances.

"All night soil collected is carried to sea in the steam barge *Pluto*, which has now been in the service about three years. This barge is supplied with a complete equipment for cleaning and disinfecting pails and excavators, and its general arrangements are such that it has filled all the requirements made upon it to an admirable degree.

"*Street sprinkling.*—This department is not equipped to sprinkle all the streets of the city by means of sprinkling wagons. Some streets have hydrants at close intervals which have been utilized for sprinkling, a length of hose with nozzle being used for this purpose. Sprinkling with hose does not cost as much per square meter sprinkled to this department as to sprinkle with wagons, but experience has proved that the expense to the city is greater on account of the injury to the streets and the expense of maintaining a large number of hydrants. Some places of small area are sprinkled by means of cans, this being the most feasible method of watering these sites.

"*Land transportation.*—The land transportation used by the various Insular Bureaus in the city of Manila and the city departments has been maintained throughout the year by this department. On June 30 there were on hand at both stables 227 American and Australian horses, 108 native horses, 7 Chinese horses, 149 American mules, and 34 Chinese mules.

"There were purchased for the use of the city stables 29 horses and 1 mule; 16 horses, 2 mules, 36 native ponies, and 4 China ponies were sold; 40 horses, 14 mules, and 1 native pony were lost by death. Surra caused the death of 11 animals at stable No. 1 during the months of December and January. As this disease had not appeared among the stock at stable No. 2, the bureau of agriculture was asked for assistance in locating its source. Inspection of the private stables near stable No. 1 by veterinarians from the bureau of agriculture resulted in the destruction of a number of private animals afflicted with the disease. Since that time the entire city has been inspected and danger of another outbreak is slight. The carromata ponies have now been in the service for several years and some of them should be discarded. The best results are obtained from Australian ponies.

"A veterinary hospital has been maintained for the treatment of diseased and injured animals. Quite a number of animals have had foot punctures from nails in the street and required careful attention to prevent lockjaw.

"Extensive repairs were required to the vehicles in use during the year as all of these have seen from one to three years' service, the repairs costing much more than the amount anticipated.

"The stable grounds were filled and improved, the stable painted, and minor repairs and alterations made.

"*Parks.*—Nearly all of the land now used for parks and that around public buildings has been filled, graded, and planted with grass and shrubbery during the last three years.

"The extensive improvements on the lawn around the Tondo police station were completed, the moat around the wall adjacent to the Luneta police station was filled, about half of the walk along the Bagumbayan drive next to the moat was graded and filled with broken shell, and grass was planted along both sides. Shell walks were placed along the Paseo de Magallanes, and a small park laid out at stable No. 1. Prison labor was used in grading part of the walk along Bagumbayan, but this work was discontinued when the rainy season set in.

"In order that there might be no difficulty in securing suitable plants and trees for new park work, a portion of the filled land at Cementerio del Norte has been set aside for nursery purposes. There are now on hand plenty of young plants and trees which can be set out as rapidly as the limited park funds will permit of further improvements.

"*Cemeteries.*—No new work has been done during the year at the Paco or La Loma cemeteries. Only the required amount of labor was used to keep them clean and in repair. Interments were made in the niches at Paco Cemetery, but no interments were made at La Loma, this cemetery having been closed the previous year.

"At Cementerio del Norte roads and bridges were built, walks laid out, drains laid, ditches dug, and extensive improvements made in grading and filling. About seventy prisoners were used in connection with the regular force in carrying on this work.

"The majority of the bodies removed from the National Cemetery at Pasay at the time this cemetery was abandoned were reinterred in the Cementerio del Norte. The monuments and headstones which had been erected over the graves at Pasay were removed to Cementerio del Norte and placed over the new graves.

"Deceased government employees not otherwise cared for were removed at the expense of the insular government to a section selected and purchased by the insular government for this purpose."

NOTE.—Statement of the expenditures for the department for the year ending June 30, 1906, is on file in the War Department.

EXHIBIT No. 5.

REPORT OF THE INSULAR TREASURER.

MANILA, *August 10, 1906.*

SIR: In compliance with Executive order No. 33, dated July 19, 1906, and in accordance with act No. 938, United States Philippine Commission, as amended by act No. 1407, I have the honor to submit my annual report for the fiscal year ending June 30, 1906.

During the period from July 1, 1905, to August 4, 1905, the management of this bureau devolved by law upon Mr. J. L. Barrett, the assistant treasurer, by reason of the absence of the treasurer on accrued leave.

Under the provisions of act No. 1407, United States Philippine Commission, the treasurer, on November 1, 1905, ceased to exercise supervision over the offices of provincial treasurers, and transferred to the auditor the entire corps of field examiners. All business relating to estates of deceased employees (act No. 290) was transferred to the attorney-general on the same date. A division of disbursements was added to the bureau, November 1, by provision of the aforementioned act.

The operations of this division for the fiscal year, including the four months previous to its identification with the bureau, may be summarized as follows:

Operation of the division of disbursements.

Account.	Inclusive dates.		Amount.
	From—	To—	
Bureau of agriculture	Nov. 1, 1905	June 30, 1906	₱160,257.91
Bureau of audits	do	do	196,496.08
Bureau of coast and geodetic survey	July 1, 1905	do	118,311.98
Bureau of civil service	do	do	68,081.56
Congressional relief fund	do	do	102,497.35
Bureau of customs	do	do	600,679.55
Bureau of education	Aug. —, 1905	do	2,125,968.23
Executive bureau	July 1, 1905	do	584,388.45
Exposition board	do	do	12,574.96
Bureau of forestry	Nov. 1, 1905	do	84,755.33
Bureau of health	July 1, 1905	do	618,549.65
Bureau of internal revenue	do	do	345,627.83
Bureau of justice	Nov. 1, 1905	do	519,471.24
Bureau of lands	July 1, 1905	do	204,881.82
Bureau of navigation	Dec. —, 1905	do	548,990.92
Bureau of printing	July 1, 1905	do	266,223.96
Bureau of port works	Nov. 1, 1905	do	813,394.58
Bureau of prisons	July 1, 1905	do	565,371.92
Bureau of public works	do	do	386,668.30
Bureau of science	do	do	200,533.94
Bureau of the treasury	Nov. 1, 1905	do	88,752.38
Weather bureau	Dec. —, 1905	do	53,926.25
Bureau of architecture [a]	Nov. 1, 1905	do	13.33
American Circulating Library [b]	July 1, 1905	Dec. 31, 1905	4,216.75
Bureau of archives [c]	do	Oct. 31, 1905	7,220.43
Consulting architect	Mar. 1, 1906	June 30, 1906	7,936.72
Ethnological survey [b]	July 1, 1905	Feb. —, 1906	5,972.10
Intendencia building [a]	Jan. 1, 1906	Mar. —, 1906	775.06
Mining bureau [d]	July 1, 1905	do	9,554.76
Official Gazette [c]	Aug. 1, 1905	do	2,942.20
Philippine civil hospital [e]	Jan. —, 1906	Apr. —, 1906	406.20
San Jose College	Apr. —, 1906		1,000.00
Santa Potenciana building [a]	Aug. 1, 1905	Dec. 31, 1905	2,059.12
Total			8,708,500.86

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[a] Consolidated with the bureau of public works.

[b] Consolidated with the bureau of education.

[c] Consolidated with the executive bureau.

[d] Consolidated with the bureau of science.

[e] Consolidated with the bureau of health.

Under the provisions of act No. 1402, all business relating to the bonds of insular officials and employees was transferred on January 1, 1906, to the insular auditor.

The object for which the currency division was created, with Mr. E. W. Kemmerer as chief, having been successfully accomplished, the division was discontinued on February 1, 1906, in accordance with provisions of act No. 1407.

The authorized personnel of the bureau at the close of the fiscal year was as follows:

Treasurer, assistant treasurer, insular disbursing officer, three clerks class 3, one clerk class 4, two clerks class 5, three clerks class 6, four clerks class 7, six clerks class 8, one clerk class 9, one clerk class A, five clerks class D, one clerk class E, three clerks class F, two clerks class G, three clerks class H, four clerks, class I, two clerks class J, and one employee at ₱480 per annum, one employee at ₱360 per annum, and three messengers at ₱360 per annum each.

The expense of conducting the bureau for the fiscal year was, for salaries and wages of officers and employees, ₱123,466.76, and for contingent expenses, such as transportation of funds, office supplies, printing, furniture, etc., ₱26,925.67, making a total of ₱150,392.43. There was received during the fiscal year as premiums on the sale of drafts on New York the sum of ₱138,503.85, and ₱613,725.80 as interest on funds deposited in banks in the United States and in Manila.

In its capacity as a depositary of government funds, this bureau handles some 410 accounts. The deposits to the credit of these accounts during the fiscal year were ₱128,385,957.795, and the withdrawals ₱129,870,095.015 and Pfs. 1,313.37, local currency, making a volume of business amounting to about ₱258,000,000 handled by the depositary during the fiscal year.

Assurance fund, act No. 496.

Balance June 30, 1905	₱6,339.31
Deposits in the fiscal year	6,954.29
Total June 30, 1906	13,293.60

Of this amount ₱9,000 was deposited with the International Banking Corporation's branch in Manila, on November 11, 1905, for one year, at 3½ per cent. As yet no interest has been collected on this deposit, but on November 11, 1906, there will be due interest amounting to ₱315. Section 100 of act No. 496, requires that the treasurer shall report annually the condition of this fund. As will be noted, the amount of cash now in the treasury vaults pertaining to the fund is ₱4,293.60. As soon as further accretions shall bring this amount to ₱5,000 it will be deposited in a bank on an interest-bearing certificate of deposit.

Treasurer's general account.

Item.	Philippine currency.	Local currency.
Balance on hand June 30, 1905	₱26,664,073.21	Pfs. 142,937.36
Receipts during fiscal year 1906, segregated as follows:		
Customs	14,828,048.65	
Export duties, refundable	894,863.62	
Internal revenue	5,689,546.615	
Miscellaneous	9,867,521.55	
Repayments	11,456,117.205	
Outstanding liabilities	4,578.25	
Postal	385,895.08	
Invalid money orders	6,738.64	
City of Manila	2,424,233.87	
Surplus, section 283, act No. 355	326.86	
Section 5 (*g*), act No. 436	84.59	
Received in exchange	46,999,956.72	
	92,557,911.65	841,759.24
Total	119,221,984.86	984,696.60
Withdrawals during the fiscal year:		
Warrants paid	52,277,265.40	745,507.00
Given in exchange	47,552,314.82	106,705.37
	99,829,580.22	852,212.37
Balance June 30, 1906	19,392,404.64	132,484.23

Depositary account.

Item.	Philippine currency.	Local currency.
Balance July 1, 1905	₱12,701,701.16	Pfs. 2,528.56
Deposits in fiscal year	128,385,957.795	
Total	141,087,658.955	2,528.56
Withdrawals in fiscal year	129,870,095.015	1,313.37
Balance June 30, 1906	11,217,563.94	1,215.19

Aggregate of all funds in hands of insular treasurer June 30, 1906.

Item.	United States currency.	Philippine currency.	Local currency.
General revenue account		₱19,392,404.64	Pfs. 132,484.23
Depositary account		11,217,563.94	1,215.19
Certificate redemption fund		14,410,000.00	
Total		45,019,968.58	133,699.42
These funds were distributed as follows:			
In treasury vaults	$4,606,299.57	18,065,090.20	133,699.42
Checks on hand for deposit		108,557.34	
In banks at Manila		308,679.77	
In banks in United States	8,513,096.315		
In banks at Manila (special deposits) [a]	9,000.00	280,733.08	
In hands provincial treasurers for exchange		116.42	
Total	13,128,395.885	18,763,176.81	133,699.42

[a] This item consists of funds deposited in the local banks on certificates of deposit for stated intervals, and bearing interest.

The item is made up as follows:

Item.	Philippine currency.	United States currency.
Rizal monument fund	₱111,052.18	
Franchise deposits	71,000.00	$9,000.00
Constabulary relief fund	50,000.00	
Sewer and waterworks sinking fund	38,740.00	
Assurance fund, act No. 496	9,000.00	
Conservatory of Music fund	940.90	
Total	280,733.08	9,000.00

CERTIFICATES OF INDEBTEDNESS.

During the period covered by this report there has been issued a fifth series of certificates of indebtedness to the sum of $1,500,000. This series was issued to take the place of the fourth series in the sum of $3,000,000, which fell due September 1, 1905. This reduction in the amount of outstanding certificates of indebtedness had been made possible by the lessened demand upon the gold standard fund incidental to the withdrawing of the old currency from circulation. During the fiscal year 1904–5 there was purchased the sum of Pfs. 8,763,591.96 of the old currency, as compared with the sum of Pfs. 841,759.24, purchased during the fiscal years 1905–6. The demands upon the gold-standard fund for this purpose have so materially fallen off during the latter months of the fiscal year, that it has been deemed best to retire the present isssue of certificates falling due September 1, 1906, and issue a new series in the sum of $1,000,000 in place thereof. With the exception of the month of August, 1905, during which the fourth series of certificates of indebtedness, amounting to $3,000,000, was paid off, there has been on deposit throughout the year in New York a sum considerably in excess of the outstanding obligations, so that the interest earned on the daily balances, $77,696.88, together with the premium realized, $24,600, has been more than sufficient up to this date to cover the interest paid out on the certificates now outstanding by the sum of $27,296.88.

COINAGE OF PHILIPPINE CURRENCY.

No silver currency has been coined during the fiscal year from bullion purchased. The only additions to the currency have been those incidental to the recoinage of the old currency, ₱1,723,351.24, and the receipt on July 10, 1905, of copper centavos to the value of ₱19,200.

RECOINAGE OF LOCAL CURRENCY.

The purchase of the old currency has continued throughout the year, though in greatly diminished quantities. There was shipped to the San Francisco mint during the fiscal year, for the purpose of recoining, the sum of Pfs. 745,507, making a total of Pfs. 16,458,507 shipped to the mint for recoining since the introduction of the new currency. Of the above amount, returns have been received from the mint covering Pfs. 16,426,707, giving the following results:

Local currency shipped for recoinage.

Character of money.	Amount.	Standard ounces produced.	Philippine-currency equivalent at 416 grains, 0.900 fine, to the peso.
Pesos	Pfs. 4,084,371.00	3,274,832.64	₱3,778,943.73
50-cent pieces	10,649,167.50	8,211,124.45	9,475,103.21
20-cent pieces	1,363,442.60	1,038,443.64	1,198,296.37
10-cent pieces	314,488.70	236,225.02	272,588.32
Miscellaneous	15,237.20	15,586.62	17,985.94
Total	16,426,707.00	12,776,212.37	14,742,917.57

The amount of old silver coins on hand together with that shipped to the mint but as yet unreported upon, Pfs. 44,985.13, would yield, on the basis of the above returns, about 34,951.44 ounces standard silver (0.900 fine), making a total of 12,811,163.81 ounces realizable from the Pfs. 16,471,692.13, local currency shipped, and that on hand June 30, 1906, This would coin about ₱14,783,249.10 Philippine currency. The cost of the local currency shipped to the mint for recoinage up to the close of the fiscal year, June 30, 1906, together with the old silver coins on hand, Pfs. 16,471,692.13, amounts approximately to ₱14,317,115.59. The expenses connected with the shipment and recoinage of the above amount of local currency have been about ₱454,749.96, so that the total expenses connected with the purchases of the old silver coins to date have been approximately ₱14,771,865.55.

If to the total estimated proceeds of the recoinage, ₱14,783,249.10, there should be added the profits on the sale of Mexican currency in Manila, the total estimated proceeds will reach the sum of ₱14,799,669.10, representing a net gain on the redemption of the old local silver currency of ₱27,803.55. Owing to the low rate (1.30) at which the larger part of the purchases of the present fiscal year have been made, the operations during this period, excluding the purchase and sale of copper coins, represent a net gain of about ₱136,557.46.

Up to the close of the present fiscal year there had been purchased the sum of Pfs. 119,299.10 local currency, in copper coins costing approximately ₱101,207. Adding to this the cost of 24,895¼ pounds of Igorot copper, at 40 cents per pound, or ₱9,958.10, the total amount expended in the purchase of copper coins would be ₱111,165.10. On the basis of the sale of this copper as bullion at the price of, say, 25 centavos per pound, there would be a net loss on the purchase of copper coins of ₱56,234.42.

It was found above that the redemption of silver currency resulted in a gain to the government of ₱27,803.55. If against this gain there be set off the estimated net loss on the purchase of copper coin, ₱56,234.42, the net result of the total process of redeeming local currency to date would be an estimated loss to the government of ₱28,430.87.

The seigniorage profits of the currency coined from bullion purchased has been estimated at ₱2,720,342.59. If we deduct from this sum the estimated net loss on the redemption of the local currency, we obtain a net seigniorage profit of ₱2,691,911.72 on the entire process of coinage and recoinage up to July 1, 1906.

PHILIPPINE CURRENCY RECEIVED.

With the exception of ₱19,200 in copper coin received July 10, 1905, the amount of Philipine currency received during the fiscal year, ₱1,723,351.24, has been derived from the recoinage of the old currency. The total amounts of the various denominations received and in circulation at the close of the year are given in the following table:

Currency received, in treasury vaults, and in circulation, and total number of coins in circulation.

Character of money.	Received.	In treasury vaults.	In circulation.	Number of coins in circulation.
Pesos	₱26,934,635.00	[a] ₱15,767,633.00	₱11,167,002.00	11,167,002
50-cent pieces	3,055,221.00	342,544.00	2,712,677.00	5,425,354
20-cent pieces	1,595,744.40	189,930.60	1,405,813.80	7,029,069
10-cent pieces	1,133,681.40	245,139.40	888,542.00	8,885,420
5-cent pieces	499,250.00	257,127.75	242,122.25	4,842,445
1-cent pieces	378,300.00	50,361.23	327,938.77	32,793,877
½-cent pieces	88,670.00	33,728.72	54,941.28	10,988,256
Total	33,685,501.80	16,886,464.70	16,799,037.10	81,131,423

[a] Including ₱14,410,000 deposited in the silver-certificate reserve fund.

If to the total circulation of Philippine coins as shown by the above table there be added the ₱13,231,374.50 silver certificates in circulation, it will be seen that the total circulation of Philippine currency is ₱30,030,411.60.

The marked decrease during the year in the amount of 5-centavo pieces in circulation, ₱30,019.80, and in the amount of one-half-centavo pieces in circulation, ₱1,897.58, is an indication of the disfavor with which these coins have been received by the people. Previous to the introduction of the new Philippine currency there was no coin in circulation corresponding to the 5-centavo piece. Greater familiarity with the coin may result in its being more extensively used in the future.

The fact that the treasurer has been called upon to exchange these coins for coins of other denominations is evidence of the wisdom of the provision, in the Philippine gold standard act, for the interchangeability of all classes of Philippine coins upon demand at the insular and provincial treasuries of the islands.

SILVER CERTIFICATES.

The amounts of silver certificates in circulation and in the reserve vaults of the treasury at the end of each quarter since the date they were first placed in circulation, October 6, 1903, have been as follows:

Amount and denomination of silver certificates in circulation.

Date.	₱2 certificates in—		₱5 certificates in—		₱10 certificates in—		Total in—	
	Circulation.	Vaults.	Circulation.	Vaults.	Circulation.	Vaults.	Circulation.	Vaults.
1903-4.								
Dec	₱212,000	₱788,000	₱285,000	₱1,715,000	₱960,400	₱3,039,600	₱1,457,400	₱5,542,600
Mar	490,000	1,510,000	670,000	3,330,000	2,860,600	1,139,400	4,020,600	5,979,400
June	850,000	1,390,000	1,050,000	3,550,000	4,100,000	1,100,000	6,000,000	6,040,000
1904-5.								
Sept	980,000	1,350,000	1,180,000	3,470,000	5,070,000	2,980,000	7,230,000	7,800,000
Dec	1,020,000	1,310,000	1,400,000	3,250,000	6,000,000	2,050,000	8,420,000	6,610,000
Mar	1,390,000	940,000	1,700,000	2,950,000	7,060,000	3,940,000	10,150,000	7,830,000
June	1,500,000	1,500,000	1,750,000	4,250,000	7,200,000	3,800,000	10,450,000	9,550,000
1905-6.								
Sept	1,500,000	1,500,000	1,800,000	4,200,000	7,200,000	3,800,000	10,500,000	9,500,000
Dec	1,600,000	1,400,000	1,800,000	4,200,000	8,200,000	2,800,000	11,600,000	8,400,000
Mar	1,680,000	1,320,000	1,820,000	4,180,000	9,650,000	1,350,000	13,150,000	6,850,000
June	1,790,000	1,210,000	1,820,000	4,180,000	10,800,000	200,000	14,410,000	5,590,000

On February 6, 1905, an act of Congress was approved by the President of the United States providing for the issuing of silver certificates in denominations of ₱20, ₱50, ₱100, and ₱500. Owing, however, to expected Congressional action in the matter of holding part of the silver-certificate reserve fund in gold, these larger denomination certificates were held in Washington, D. C. On June 23, 1906, an act of Congress was approved providing that the treasurer of the Philippine Islands could hold as high as 60 per cent of the silver certificate reserve fund in gold coin of the United States against all certificates thereafter issued. In conformity to the new law the larger denomination certificates were surcharged with the legend "Subject to the provisions of the act of Congress approved June 23, 1906," and will be shipped to Manilla shortly after July 1, 1906.

The larger denomination certificates will supply a long felt need. The banks will welcome them as a more convenient form in which to hold their large cash reserves, and the public generally because of the unusually large number of heavy cash transactions incident to local business conditions.

The privilege of holding up to 60 per cent of the reserve against silver certificates in gold coin will prove of great value to the government, for thereby the amount of available silver currency can be very materially increased and the necessity avoided of coining more pesos in times when the price of silver bullion would yield no seigniorage or even involve an actual loss.

Under the new law the silver certificate will no longer be, strictly speaking, a silver certificate. It will, however, lose none of its strength on this account, but rather be the more secure.

GOLD-STANDARD FUND.

The following is a summary of the operations of the gold-standard fund for the fiscal year ending June 30, 1906:

Operations of the gold-standard fund.

Item.	Fund in Manila.		Fund in New York, United States currency.
	Philippine currency.	United States currency.	
DEBIT.			
Balance, June 30, 1905	₱1,022,727.42	$869,439.82	$2,303,548.65
New coin received	1,742,551.24		
Currency exchanges	8,024,413.26	12,629,864.67	
Transfers with Army, Navy, etc			8,660,797.35
Other transfers			593,174.00
Certificates of indebtedness, fifth series			1,500,000.00
Premium on same			24,600.00
New York exchange	14,895,721.96	7,000.00	
Premiums on New York exchange	138,503.85		
Sale of local currency	101,058.16		
Interest on gold-standard fund in New York			77,696.88
Proof sets sold	.66		766.00
Redemption silver certificates in New York	1,036.00	1,690.50	
Miscellaneous	11,361.56		
Total	25,937,374.11	13,507,994.99	13,160,582.88
CREDIT.			
Currency exchanges	25,259,729.34	4,012,001.13	205.50
Transfers with Army, Navy, etc		8,660,797.35	
Other transfers		593,174.00	
Local currency purchased	653,414.26		
New York exchange			7,454,860.98
Certificates of indebtedness			3,000,000.00
Interest of certificates of indebtedness			75,000.00
Redemption of silver certificates in New York			2,208.50
Adjustment by auditor of J. G. Jester's account	72,007.38		
Miscellaneous	11,642.42		180.00
Accountable warrants	11,506.79		
Total	26,008,300.19	13,265,972.48	10,532,454.98
Balance, June 30, 1906	70,926.08	242,022.51	2,628,127.90
Total	25,937,374.11	13,507,994.99	13,160,582.88

The status of the gold-standard fund at the end of each month during the fiscal year has been as follows:

Status of the gold-standard fund.

Date.	Philippine currency.	United States currency.	Fund in New York, United States currency.	Total fund ($1 = ₱2), Philippine currency.
1905–6.				
July	₱755, 530. 46	$908, 095. 56	$2, 491, 923. 05	₱7, 555, 567. 68
August	103, 934. 39	532, 917. 45	[a] 101, 991. 85	1, 373, 752. 99
September	948, 548. 30	418, 273. 99	1, 682, 420. 03	5, 022, 350. 17
October	820, 962. 13	142, 367. 39	2, 111, 509. 74	5, 328, 716. 39
November	454, 578. 33	711, 268. 93	1, 787, 349. 01	4, 997, 314. 21
December	265, 300. 58	38, 538. 52	2, 588, 912. 34	5, 520, 202. 30
January	326, 933. 86	201, 891. 31	2, 378, 819. 46	5, 488, 355. 40
February	75, 075. 01	7, 666. 57	2, 842, 410. 53	5, 625, 079. 19
March	216, 173. 36	62, 528. 99	2, 656, 336. 24	5, 653, 903. 82
April	358, 200. 61	241, 792. 60	2, 441, 265. 78	5, 724, 317. 37
May	851, 693. 63	248, 013. 56	3, 012, 304. 51	5, 668, 942. 51
June	70, 926. 08	242, 022. 51	2, 628, 127. 90	5, 669, 374. 74

[a] The heavy decline in the gold-standard fund balance in New York for August 31 is largely nominal. The proceeds of the fifth series of certificates of indebtedness were received in New York September 1, while the fourth series was paid off August 31.

It will be noted that during three months of the latter part of the fiscal year the Philippine currency fund in Manila was overdrawn. It has been evident for several months past that the supply of Philippine currency was becoming insufficient to meet the increased demands upon it incident to the gradual improvement in business conditions in the islands. That the overdrawn condition of the Philippine currency fund noted above was due to this cause seems evidenced by the fact that it has existed during a period when the demand for exchange on New York was fairly heavy.

GOLD-STANDARD FUND DRAFTS.

The record of gold-standard fund drafts sold in Manila on the gold-standard fund in New York since the inauguration of the new currency system appears in the following table:

Drafts on the gold-standard fund.

Date.	Sold to banking institutions.		Sold to commercial firms and individuals.		Total sold.	Premiums realized.
	Telegraphic transfers.	Demand drafts.	Telegraphic transfers.	Demand drafts		
1903–4.						
October	$100,000.00	$400,000.00		$1,500.00	$501,500.00	$8,272.50
November	50,000.00	100,000.00			150,000.00	2,625.00
December	300,000.00	50,000.00	$27,000.00	18,588.66	395,588.66	8,385.87
January	50,000.00		10,000.00		60,000.00	1,350.00
February						
March	970,000.00		10,000.00	20,110.79	1,000,110.79	22,351.66
April	500,000.00	20,000.00	10,000.00	10,431.52	540,431.52	11,931.48
May	250,000.00	50,000.00	45,000.00	23,627.26	368,627.26	7,741.92
June		220,000.00	50,867.48	51,829.32	322,696.80	5,221.97
Total	2,220,000.00	840,000.00	152,867.48	126,087.55	3,338,955.03	67,880.40
1904–5.						
July		60,000.00	3,000.00	18,419.87	81,419.87	1,243.79
August		185,000.00			185,000.00	2,775.00
September		140,000.00		26,713.29	166,713.29	2,500.70
October		40,000.00	40,000.00	58,076.38	98,076.38	1,771.14
November				2,233.25	2,233.25	33.50
December				183.62	183.62	2.76
January						
February				5,000.00	5,000.00	75.00
March				8,309.85	8,309.85	124.66
April	250,000.00		20,000.00	6,417.47	276,417.47	6,171.28
May	550,000.00	40,000.00		58,578.14	648,578.14	13,853.69
June	500,000.00	236,000.00		29,064.68	765,064.88	15,225.98
Total	1,300,000.00	701,000.00	63,000.00	212,996.55	2,236,996.75	43,777.50
1905–6.						
July	300,000.00	60,000.00		76,765.79	436,765.79	8,801.48
August	400,000.00	200,000.00	200,000.00	60,116.70	860,116.70	17,401.75
September	525,000.00	100,000.00	15,000.00	4,033.32	644,033.32	13,710.50
October	350,000.00	235,000.00	19,667.02	15,863.77	620,530.79	12,080.46
November	750,000.00	60,000.00	25,000.00	26,643.07	861,643.07	18,737.14
December	325,000.00	85,000.00	77,500.00	3,747.17	491,247.17	10,387.45
January	250,000.00	210,000.00	25,000.00	250,330.43	735,330.43	13,298.68
February			30,000.00	7,285.53	37,285.53	784.28
March	500,000.00	6,000.00	30,000.00	150,034.29	686,034.29	10,290.51
April	750,000.00		60,000.00	4,320.46	814,320.46	12,214.80
May	260,000.00	3,734.52	100,000.00	19,853.30	383,587.82	4,253.80
June	760,000.00		95,876.48	28,089.13	883,965.61	14,630.50
Total	5,170,000.00	959,734.52	678,043.50	647,082.96	7,454,860.98	[a] 136,591.35

[a] In addition to this amount there was received from the government ₱1,912.50 as premium on telegraphic transfers outside of the gold-standard fund.

The Philippine currency paid into the treasury for the above-mentioned drafts was withdrawn from circulation as provided in section 7 of the Philippine gold-standard act.

The increased demand for Philippine currency in the islands, together with the heavy sums paid out in Philippine currency for the Army and Navy in Manila in return for United States currency deposited in New York (equivalent in nature to the sale of exchange in New York on Manila), has depleted the supply of Philippine currency. To such an extent had this occurred in March, 1906, that it was deemed expedient by the honorable secretary of finance and justice to temporarily lower the rate of exchange in Manila for telegraphic transfers, and an order was issued accordingly on March 15, 1906, fixing the rate at three-fourths of 1 per cent. This resulted in bringing into the treasury almost immediately something over ₱1,000,000 of Philippine currency. The relief afforded, however, was only temporary, and it soon became evident that it would be necessary to make disbursements in United States currency in the near future, and also that it would be necessary to import the same from treasury funds in New York, where both the gold standard and the general funds were constantly accumulating, owing to the heavy demand by the Army and Navy for exchanges.

On March 22, 1906, the Secretary of War was requested to withdraw the sum of $600,000 from the funds on deposit in the New York depositaries and ship the same to Manila. Later, on May 17, 1906, another request was made for the sum of $1,250,000. By a constant shifting of funds in Manila the treasurer has been enabled to make nearly all disbursements in Philippine currency, though considerable amounts of United States currency were paid out to those who were willing to accept the same.

Although no exchange has yet been sold in New York on Manila, the heavy exchanges made with the Army and Navy, as above stated, are in their effects essentially the same, for they result in United States currency being deposited in New York and its equivalent in Philippine currency being drawn out in Manila. The fact that coincident with the demand for these heavy exchanges there was an increased demand for currency in the islands created such a demand for Philippine currency that nothing short of the purchase of silver bullion and the coinage of more currency would have met the situation had it not been for the timely action of Congress in granting the privilege of releasing 60 per cent of the silver coin held in the reserve fund against silver certificates and its replacement by an equivalent amount of gold coin.

The coining of a sufficient sum of silver currency to relieve the situation at this time would have involved the government in a loss of several thousand pesos owing to the high price of silver bullion. It is believed that the privilege of releasing so large an amount of the silver certificate reserve fund will supply a sufficient amount of Philippine currency to meet the demands of an increased circulation in that currency for several years to come.

PHILIPPINE CURRENCY AND UNITED STATES CURRENCY EXCHANGES.

The following exchanges of Philippine currency and United States currency have been made by the insular treasurer, pursuant to section 7 of the Philippine gold-standard act, since October 10, 1903, the date of the passage of that act:

Currency exchanges.

Quarter ending—	Sold.		Bought.	
	Philippine currency.	United States currency.	Philippine currency.	United States currency.
1903–4.				
December 31	₱1,242,076.36	$484,231.38	₱968,462.76	$621,038.18
March 31	2,761,591.66	811,506.70	1,623,013.40	1,380,795.83
June 30	3,304,755.56	749,283.46	1,498,566.92	1,652,377.78
Total	7,308,423.58	[a] 2,045,021.54	4,090,043.08	3,654,211.79
1904–5.				
September 30	4,815,476.82	847,482.07	1,694,964.14	2,407,738.41
December 31	5,721,983.32	1,438,252.89	2,876,505.78	2,860,991.66
March 31	5,802,107.77	2,349,416.10½	4,698,832.21	2,901,053.88½
June 30	7,232,131.18	1,122,062.91	2,244,125.82	3,616,065.59
Total	23,571,699.09	5,757,213.97½	11,514,427.95	11,785,849.54½
1905–6.				
September 30	6,256,373.64	779,558.15	1,559,116.30	3,128,186.82
December 31	6,513,216.42	757,945.38	1,515,890.76	3,256,608.21
March 31	6,010,797.00	1,458,384.98	2,916,769.96	3,005,398.50
June 30	6,479,342.28	1,016,318.12	2,032,636.24	3,239,671.14
Total	25,259,729.34	4,012,206.63	8,024,413.26	12,629,864.67

[a] In addition to the above sales of United States currency there was sold during the year, at a premium of 1.6 per cent, $7,395 United States gold coin, under the provisions of paragraph 3, section 7, act No. 938.

The greater part of the above transactions represent exchanges for the army, navy, and different departments of the Philippine civil government. Nearly all disbursements of the army are now made in Philippine currency, though their depositary accounts are kept in United States currency.

LOCAL CURRENCY.

WITHDRAWAL OF LOCAL CURRENCY.

It may now be said with safety that the old local currency has entirely ceased to circulate in the islands. The purchase of local currency has continued throughout the fiscal year at the rate of 1.30. The sum of Pfs. 841,759.24 has been purchased during this period for the sum of ₱653,414.26. Of this amount, Pfs. 106,705.37, Mexican and Chinese currency, have been sold in Manila for the sum of ₱101,058.16, representing a net gain of about ₱18,975.

The purchase of local currency for the fiscal year 1904–5 amounted to Pfs. 8,763,591.96, and involved a cost of ₱7,647,762.38. It will be seen from a comparison of these figures with those above for the present fiscal year that the local currency has been pretty well drained out of the country. Undoubtedly considerable amounts of the old currency still remain hoarded in the more remote parts of the islands, which nothing will draw out save the actual necessities of the owners. In view of these facts it is recommended that the purchase of local currency be discontinued at the close of the present calendar year, December 31, 1906. It is probable that little, if any, hardship will be worked upon the common people by such action. The present regulations in regard to the purchase and sale of local currency by individuals or firms should, however, be continued in force, the outlet thus afforded being deemed sufficient.

The following table gives the amounts of local currency and the rates at which purchased:

Local currency purchased during fiscal year 1905–6.

Rate.	Amount.	Cost.
1.30	Pfs. 740, 439. 65	₱569, 569. 92
1.25	47, 302. 67	37, 842. 12
1.20	38, 808. 54	32, 340. 42
1.18	915. 92	776. 20
1.14	2, 964. 11	2, 600. 09
1.13	Pfs. 497. 26	₱440. 05
1.12	. 58	. 52
1.10	10, 830. 51	9, 844. 94
Total	841, 759. 24	653, 414. 26

The official rate prevailing during the entire year was 1.30. That purchases are reported above as being made at other rates is due to the fact that while these purchases were made by provincial treasurers prior to the present fiscal year, when these higher rates were in force, they were received by the treasurer during the present fiscal year.

LOCAL CURRENCY SHIPMENTS.

The exports of local currency for the present fiscal year have been as follows:

Commercial	Pfs. 1, 027, 854. 15
Governmental	745, 507. 00
Total	1, 773, 361. 15

The totals for the period from July 1, 1903, to July 1, 1906, are as follows:

Commercial	Pfs. 18, 177, 452. 05
Governmental	16, 458, 507. 00
Total	34, 635, 959. 05

The exportations made by the government all refer to shipments of Spanish-Filipino money to San Francisco for recoinage. It should be added that during the period last referred to there was imported the sum of Pfs. 2,168,703 before the passage of the law, January 14, 1904, prohibiting the importation of local currency.

Philippine currency circulation.

Date.	Amount in circulation.	Increase (+) or decrease (−).	Date.	Amount in circulation.	Increase (+) or decrease (−).
1903-4.			1904-5—Cont'd.		
November	₱3,993,058	....	March	₱27,044,715	+₱331,759
December	3,910,393	− ₱82,665	April	28,839,477	+1,794,761
January	5,484,295	+1,573,902	May	28,054,738	− 784,739
February	6,233,827	+ 749,532	June	28,160,667	+ 105,929
March	7,402,368	+1,168,541			
April	6,718,799	− 683,569	1905-6.		
May	8,226,114	+1,507,315	July	27,460,628	− 700,039
June	9,057,127	+ 831,013	August	27,291,621	− 169,007
			September	27,605,390	+ 313,768
1904-5.			October	28,067,671	+ 462,280
July	10,481,955	+1,424,828	November	27,060,682	−1,006,988
August	12,362,617	+1,880,662	December	28,451,846	+1,391,163
September	14,253,799	+1,891,182	January	28,257,320	− 194,525
October	15,963,043	+1,709,244	February	29,401,435	+1,144,115
November	18,003,984	+2,040,941	March	29,663,356	+ 261,920
December	20,765,524	+2,761,540	April	29,679,865	+ 16,509
January	24,449,679	+3,684,154	May	30,409,815	+ 729,949
February	26,712,956	+2,263,277	June	30,030,411	− 379,403

EXCHANGE RATES.

In continuation of the table of exchange rates submitted as an appendix to the last annual report of the chief of the division of the currency, the following table has been prepared, covering the present fiscal year:

London price of silver and Hongkong and Manila sterling exchange rates, 1905-6.

Year.	London price of standard silver.				Average value of Mexican dollar.	Sterling rates in Hongkong, telegraphic transfers.				Sterling rates in Manila, telegraphic transfers.			
	High.	Low.	Mean.	Average.		High.	Low.	Mean.	Average.	High.	Low.	Mean.	Average.
1905.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
July	$27\frac{5}{16}$	$26\frac{7}{8}$	$27\frac{3}{32}$	$27\frac{5}{32}$	$23\frac{1}{16}$	$22\frac{3}{4}$	$22\frac{7}{16}$	$22\frac{19}{32}$	$22\frac{19}{32}$	$24\frac{1}{4}$	$24\frac{1}{4}$	$24\frac{1}{4}$	$24\frac{1}{4}$
August	$28\frac{3}{4}$	$27\frac{1}{4}$	28	$27\frac{27}{32}$	$23\frac{9}{16}$	$23\frac{3}{8}$	$22\frac{5}{8}$	23	$22\frac{15}{16}$	$24\frac{1}{4}$	$24\frac{1}{4}$	$24\frac{1}{4}$	$24\frac{1}{4}$
September	$28\frac{3}{4}$	28	$28\frac{3}{8}$	$28\frac{17}{32}$	$24\frac{1}{4}$	$23\frac{7}{16}$	$22\frac{15}{16}$	$23\frac{3}{16}$	$23\frac{9}{32}$	$24\frac{5}{16}$	$24\frac{1}{4}$	$24\frac{9}{32}$	$24\frac{9}{32}$
October	$28\frac{15}{16}$	$28\frac{5}{16}$	$28\frac{5}{8}$	$28\frac{5}{8}$	$24\frac{5}{16}$	$23\frac{11}{16}$	$23\frac{3}{16}$	$23\frac{7}{16}$	$23\frac{7}{16}$	$24\frac{5}{16}$	$24\frac{5}{16}$	$24\frac{5}{16}$	$24\frac{5}{16}$
November	$30\frac{5}{16}$	$28\frac{7}{8}$	$29\frac{19}{32}$	$29\frac{13}{32}$	25	$25\frac{1}{8}$	$23\frac{5}{8}$	$24\frac{3}{8}$	$24\frac{15}{32}$	$24\frac{5}{16}$	$24\frac{5}{16}$	$24\frac{5}{16}$	$25\frac{5}{16}$
December	$30\frac{5}{16}$	$29\frac{3}{8}$	$29\frac{27}{32}$	$29\frac{31}{32}$	$25\frac{11}{32}$	$25\frac{1}{16}$	$24\frac{1}{4}$	$24\frac{21}{32}$	$24\frac{17}{32}$	$24\frac{5}{16}$	$24\frac{5}{16}$	$24\frac{5}{16}$	$24\frac{5}{16}$
Year	$30\frac{5}{16}$	$25\frac{7}{16}$	$27\frac{7}{8}$	$27\frac{27}{32}$	$23\frac{5}{8}$	$25\frac{1}{8}$	$21\frac{13}{16}$	$23\frac{15}{32}$	$23\frac{1}{8}$	$24\frac{1}{2}$	$24\frac{1}{4}$	$24\frac{3}{8}$	$24\frac{11}{32}$
1906.													
January	$30\frac{1}{4}$	$29\frac{1}{16}$	$29\frac{21}{32}$	$29\frac{31}{32}$	......	$24\frac{15}{16}$	$24\frac{1}{4}$	$24\frac{11}{16}$	$24\frac{9}{16}$	$24\frac{5}{16}$	$24\frac{5}{16}$	$24\frac{5}{16}$	$24\frac{5}{16}$
February	$30\frac{13}{16}$	$30\frac{1}{8}$	$30\frac{15}{32}$	$30\frac{7}{16}$	......	$25\frac{1}{16}$	$24\frac{1}{4}$	$24\frac{13}{16}$	$24\frac{5}{18}$	$24\frac{3}{8}$	$24\frac{5}{16}$	$24\frac{11}{32}$	$24\frac{3}{8}$
March	$30\frac{3}{8}$	29	$29\frac{13}{16}$	$29\frac{5}{8}$	......	$25\frac{1}{16}$	$24\frac{1}{4}$	$24\frac{21}{32}$	$24\frac{1}{2}$	$24\frac{7}{16}$	$24\frac{3}{8}$	$24\frac{13}{32}$	$24\frac{13}{32}$
April	$30\frac{11}{16}$	$29\frac{5}{8}$	$30\frac{5}{16}$	$29\frac{31}{32}$	......	25	$24\frac{1}{2}$	$24\frac{3}{4}$	$24\frac{23}{32}$	$24\frac{7}{16}$	$24\frac{7}{16}$	$24\frac{7}{16}$	$24\frac{7}{16}$
May	$31\frac{3}{8}$	$30\frac{3}{16}$	$30\frac{25}{32}$	$30\frac{23}{32}$	......	$25\frac{1}{2}$	$25\frac{1}{16}$	$25\frac{9}{32}$	$25\frac{4}{16}$	$24\frac{7}{16}$	$24\frac{7}{16}$	$24\frac{7}{16}$	$24\frac{7}{16}$
June	$31\frac{1}{8}$	$29\frac{9}{16}$	$30\frac{11}{32}$	$30\frac{1}{8}$	......	$25\frac{9}{16}$	$25\frac{1}{16}$	$25\frac{5}{16}$	$25\frac{5}{16}$	$24\frac{7}{16}$	$24\frac{7}{16}$	$24\frac{7}{16}$	$24\frac{7}{16}$
Half year	$31\frac{3}{8}$	29	$30\frac{3}{16}$	$30\frac{1}{8}$	......	$25\frac{9}{16}$	$24\frac{1}{4}$	$24\frac{29}{32}$	$24\frac{27}{32}$	$24\frac{7}{16}$	$24\frac{5}{16}$	$24\frac{3}{8}$	$24\frac{13}{32}$

BANK EXAMINATIONS.

Act No. 52, as amended by act No. 556, provides that all banking institutions shall be examined by the insular treasurer once every six months. To carry out the above provisions would require the entire services of two bank examiners. It was only on February 1, 1906, that any regular appointment as bank examiner was made, and the larger part of his time has been taken up in the administration of the affairs of the American Bank of Manila, P. I., and the Bank of Pangasinan of Dagupan, P. I., both of which have been closed under the provisions of the above acts.

Examinations, however, have been made during the fiscal year of the following banks: The Bank of Zamboanga, Zamboanga, P. I.; The Bank of Pangasinan, Dagupan, P. I.; The Monte de Piedad and Savings Bank, Manila, P. I.; The Banco Español Filipino, Manila, P. I.

The liquidation of the affairs of the American Bank has entailed a large amount of extra work, and its affairs are yet unsettled, owing to the pending of several cases in the courts of the Islands. There have been paid to the creditors of the bank, other than stockholders, two dividends, one of 25 per cent and the other of 20 per cent. A favorable outcome of the cases now in the courts will enable the receiver to pay another small dividend of about 10 per cent.

An examination of the Bank of Pangasinan made December 16, 1905, revealed the fact that the bank was doing business almost entirely upon funds of the various municipalities of the province, for the depositing of which in said bank there was no warrant of law. The removal of these municipal funds, which was absolutely necessary, would have resulted in the closing of the bank, for without their use it was admitted by the cashier and manager of the bank that it would be impossible to continue its existence. Under these circumstances it was deemed best that the liquidation of its affairs should be placed in the hands of the government. An order to this effect was accordingly issued by the honorable governor-general, and the bank placed in the hands of the bank examiner, acting as deputy of the treasurer, on January 6, 1906.

The settlement of the affairs of this bank has proceeded rapidly. The creditors of the bank, other than stockholders, have been paid in full, and there remains on hand at the present time sufficient funds to pay about 90 per cent of the claims of stockholders. So far no cases have been carried into the courts in connection with the settlement of the bank's affairs, and it is hoped that a final settlement may be arrived at without any such intervention.

All of which is respectfully submitted.

FRANK A. BRANAGAN,
Treasurer Philippine Islands.

The SECRETARY OF FINANCE AND JUSTICE,
Manila, P. I.

EXHIBIT No. 6.

REPORT OF THE AUDITOR FOR THE PHILIPPINE ISLANDS.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS,
BUREAU OF AUDITS,
Manila, P. I., August 10, 1906.

SIRS: In compliance with the requirements of section 60 of act No. 1402, I have the honor to submit this my sixth annual report of the fiscal affairs of the government for the fiscal year 1906, showing the transactions at the insular treasury and the receipts and disbursements of the various departments, bureaus, and offices of the insular government, the various provinces, and the city of Manila and other pertinent information.

The organization of the office and the personnel of the executive staff at the close of the fiscal year were as follows:

Auditor, A. L. Lawshe.
Deputy auditor, William W. Barre.
Chief clerk, William H. Clarke.
Bookkeeping division, C. H. Fullaway, chief.
Customs division, A. J. Gibson, chief.
Postal division, William A. Walsh, chief.
Miscellaneous division, C. H. French, chief.
Internal-revenue division, H. W. Gangnuss, chief.
Property division, C. A. Smith, chief.
Provincial division, W. A. Randall, chief district auditor.

The authorized personnel at the close of the fiscal year was as follows: Auditor, deputy auditor, chief clerk, chief district auditor, 2 clerks class 3, 5 clerks class 4, 3 clerks class 5, 12 clerks class 6, 11 clerks class 7, 16 clerks class 8, 16 clerks class 9, 6 clerks class 10, 3 clerks class A, 2 clerks class B, 3 clerks class C, 2 clerks class D, 1 clerk class E, 4 clerks class F, 3 clerks class G, 2 clerks class H, 15 clerks class I, 8 clerks class J, 4 messengers.

The work of the office is distributed as follows:

Bookkeeping division.—Treasurer's general account, treasurer's depositary account, issuance of warrants, general bookkeeping, and compilation of all insular statistical reports.

Customs division.—Bureau of customs, bureau of navigation, bureau of port works, bureau of coast and geodetic survey, bureau of printing, bureau of agriculture, and weather bureau.

Internal-revenue division.—Bureau of internal revenue, city of Manila; bureau of forestry, bureau of justice, and bureau of public works.

Postal division.—Bureau of posts, signal service, bureau of cold storage, bureau of civil service, and bureau of audits.

Miscellaneous division.—Executive bureau, bureau of constabulary, bureau of education, bureau of health, quarantine service, bureau of prisons, bureau of science, bureau of lands, bureau of the treasury, special accounts of the insular treasurer, and all miscellaneous accounts not especially enumerated.

Property division.—Insular property, bureau of supply, and accounts of insular disbursing agent at Washington.

Provincial division.—Supervision of district auditors (including field examinations), revision of provincial and municipal accounts, and compilation of statistical records of such accounts.

In addition to the divisions named there are a detailing and verifying section and a typewriting section. The former prepares detailed statements of all expenditures for transmittal to the Secretary of War and verifies mathematical calculations on vouchers. This section is in reality the training school for young Filipino clerks. The general typewriting of the office is concentrated in the latter section for greater effectiveness.

The increase in the force over the preceding year was due to the general reorganization of the service, under which the auditor took over from the treasury and other bureaus the field examinations of accounts and the work of fixing, executing, and filing of the bonds of insular, provincial, and municipal officials required by law to give security for public money or property in their hands.

The work of the office is current, so far as accounts rendered to the auditor are concerned and the work of the district auditors is rapidly being brought to date. Insular accounts are now being audited as soon as received. Under existing law all collecting and disbursing officers of the government are allowed ten days after the close of each month during which to prepare and submit their accounts, which as a rule reach the auditor within the month, but in the cases of officers stationed at remote points, with infrequent mails and limited transportation facilities, it is often impossible to hear from them either by mail or through a field examiner for several weeks at a time. Were every collecting and disbursing officer within as easy communication with the auditor as are those in the United States, where even the most remote points (except those in Alaska) are but five or six days distant from the accounting officers, the work of this office would be vastly simplified. Under existing conditions several weeks must pass after the close of a fiscal year before all of the accounts necessary to the compilation of a complete report are available.

SUMMARY OF FISCAL TRANSACTIONS EXPRESSED IN UNITED STATES CURRENCY.

Two pesos of Philippines currency being equivalent to $1 of United States currency, the following table, expressed in United States currency, shows in condensed form the results of the year's fiscal transactions by the insular, provincial-municipal governments, the city of Manila, and the several bond-issue funds. All of these subdivisions are separate entities in the Philippine fiscal system, and must be so considered for the purpose of determining the true financial condition of the respective branches of the government:

Insular.

Net revenues, excluding refundable items:	
Customs	$7,419,826.93
Postal	242,114.38
Insular internal	2,565,395.36
Miscellaneous	1,240,730.49
Total	11,468,067.16
Net ordinary expenditures, including interest on bond issues	8,698,178.28
Contribution to city of Manila under its charter	669,192.87
Contribution to provinces in lieu of land taxes	666,927.50
Contribution to provinces for provincial administration	99,672.78
Contribution to provinces in cancellation of loans	12,807.69
Total	10,146,779.12
Excess insular revenues over expenditures	1,321,288.04

Provincial.

Provincial revenues collected in provinces	$2,765,978.35
Provincial internal revenue	777,389.96
Contribution from insular government in lieu of land taxes	666,927.50
Contribution from insular government, provincial administration	99,672.78
Contribution from insular government, cancellation of loans	12,807.69
Contribution from Congressional relief fund	145,235.66
Contribution by popular subscription in provinces	41,560.08
Total	4,509,572.02

Expenditures for ordinary provincial purposes, roads, bridges, secondary schools, etc	1,857,647.37
Proportion of provincial receipts accruing to municipalities which approximately represents the cost of municipal governments, exclusive of Manila, including primary schools	2,477,443.95
Total	4,335,091.32
Excess provincial receipts over expenditures	174,480.70

Loans to provinces by insular government are excluded.

City of Manila.

Revenues collected by city	$1,326,096.98
Contribution by insular government to city under charter	669,192.87
Total	1,995,289.85
Ordinary expenditures of city, including interest and sinking fund charges on sewer-construction bonds	2,492,392.23
Excess Manila expenditures over receipts	497,102.38

In addition, $271,707.02 was disbursed for insular purposes from Congressional relief fund, besides $145,235.66 disbursed from same fund to provinces. There was also disbursed funds derived from bond issues: $1,344,813.87 for public works, harbor, and light-house improvements; $300,310.17 on account of sewer and waterworks construction, and $3,621,660.34 for completion purchase friar lands.

RECEIPTS AT AND WITHDRAWALS FROM THE INSULAR TREASURY.

The following statement comprehends all receipts of funds from every source by the insular treasurer, as well as all disbursements made by him in his various capacities as receiver of public revenues, as depository of trust funds and funds derived from bond issues, as the central office for exchange of currency, and as custodian of the funds of disbursing officers of the Philippine government and of the United States Government. All transactions covering funds coming into or going out of the hands of the insular treasurer are audited by this office. The greater part of the funds received by the insular treasurer are not available for the ordinary expenses of government. The treasurer's account is, therefore, segregated for convenience into the following schedules:

A. Net income receipts of the insular government.

B. Other receipts.

C. Net expense withdrawals.

D. Other withdrawals.

E. Funds available for insular government administration, or funds available for appropriation, and appropriations undrawn.

F. Other funds in the treasury for which the insular government is liable.

Schedules E and F combined show the elements comprising the treasury balance at the close of the fiscal year, June 30, 1906. This balance is less than the actual cash balance in the hands of the insular treasurer in the sum of warrants delivered but not presented for payment.

Any differences which may appear between the net income receipts (Schedule A) and the actual receipts by departments, bureaus, and offices, shown later in this report, will be reconciled by the net differences between the balances in the hands of collecting officers at the beginning and the balances in their hands at the close of the year. Likewise the differences between the net expense withdrawals and the actual expenditures will be reconciled by the net balances in the hands of disbursing officers at the beginning and at the close of the year. Such differences represent but a small percentage.

The last official rate between Mexican and Spanish-Filipino currencies and Philippines currency was 1.30 of the former to 1 of the latter. While Mexican and Spanish-Filipino currencies are no longer received or paid by the government in connection with government obligations, the insular treasurer is authorized to purchase the obsolete currency when offered at the rate named.

These transactions are confined to the gold-standard fund and are stated arbitrarily in Philippines currency at the expression ratio named.

RECEIPTS AT AND WITHDRAWALS FROM THE TREASURY.

Statement of the finances of the government for the fiscal year ended June 30, 1906, from the standpoint of receipts at and withdrawals from the insular treasury, including Mexican and Spanish-Filipino currency transactions at the official ratio of ₱1 to Pfs. 1.30:

Recapitulation.

Balance July 1, 1905 (cash balance, ₱49,927,671.23, less outstanding warrants, ₱95,348.37)		₱49,832,322.86
Net income receipts of the insular government, per schedule A	₱22,890,063.82	
Other receipts, per Schedule B	191,000,256.865	
Total receipts		213,890,320.685
Grand total		263,722,643.545
Net expense withdrawals of the insular government, per Schedule C	₱19,709,416.39	
Other withdrawals, per Schedule D	198,986,664.635	
Total withdrawals		218,696,081.025
Balance June 30, 1906 (cash balance, ₱45,122,814.29, less outstanding warrants, ₱96,251.77)		45,026,562.52
Grand total		263,722,643.545

Segregation of balance of June 30, 1906.

Available funds for insular government administration, per Schedule E	₱6,174,690.85
Other funds, per Schedule F	38,851,871.67
Total	45,026,562.52

SCHEDULE A.

Net income receipts of the insular government.

General fund:	
Customs revenue	₱14,862,485.62
Postal revenue	385,895.08
Internal revenue	5,247,398.09
Miscellaneous revenues	2,394,285.03
Total carried to recapitulation sheet	22,890,063.82

SCHEDULE B.

Other receipts.

City of Manila fund: Municipal revenue		₱3,650,928.32
Gold standard fund:		
Miscellaneous revenue	₱219,540.97	
New Philippines coin	1,729,981.80	
Premium on New York drafts	140,228.85	
Currency received in exchange	47,647,463.83	
Principal of fifth series, certificate of indebtedness	3,000,000.00	
Total		52,737,215.45
Public works and permanent improvements fund: Principal and premium on second issue of bonds, par value $1,000,000		2,167,494.00
Friars' lands fund: Miscellaneous revenue		98,661.30
Depositary funds		128,385,957.795
Silver certificates reserve		3,960,000.00
Grand total carried to recapitulation sheet		191,000,256.865

SCHEDULE C.

Net expense withdrawals of the insular government—General fund.

PHILIPPINE COMMISSION.

Philippine Commission: Salaries of the president and seven commissioners		₱79, 610. 82
Total for the Philippine Commission		79, 610. 82

EXECUTIVE DEPARTMENT.

Executive: Salaries of the governor-general and secretaries of the several departments		106, 020. 00
Executive bureau:		
Salaries and wages	₱277, 805. 23	
Contingent expenses	152, 269. 46	
		430, 074. 69
Bureau of civil service:		
Salaries and wages	67, 006. 66	
Contingent expenses	8, 501. 56	
		75, 508. 22
Bureau of archives (consolidated with executive bureau as of November 1, 1905):		
Salaries and wages	5, 338. 34	
Contingent expenses	413. 11	
		5, 751. 45
Official Gazette (consolidated with executive bureau as of November 1, 1905):		
Salaries and wages	2, 136. 39	
Contingent expenses	1. 37	
		2, 137. 76
Total for the executive department		619, 492. 12

DEPARTMENT OF THE INTERIOR.

Bureau of health:		
Salaries and wages	₱374, 759. 45	
Contingent expenses	413, 206. 13	
Care of lepers in Occidental Negros	600. 00	
Culion leper colony	22, 883. 59	
		811, 449. 17
Bureau of lands:		
Salaries and wages	184, 086. 40	
Contingent expenses	68, 757. 58	
		252, 843. 98
Bureau of science:		
Salaries and wages	191, 188. 76	
Contingent expenses	84, 404. 19	
Refundable appropriation for purchase of books (excess of refunds)	2, 960. 80	
		272, 632. 15
Bureau of agriculture:		
Salaries and wages	174, 828. 80	
Contingent expenses	89, 312. 74	
		264, 141. 54
Bureau of forestry:		
Salaries and wages	113, 888. 70	
Contingent expenses	34, 302. 62	
		148, 191. 32
Quarantine service:		
Salaries and wages	76, 475. 55	
Contingent expenses	44, 388. 55	
		120, 864. 10

Weather bureau:		
Salaries and wages	₱68, 721. 34	
Contingent expenses	22, 592. 04	
		₱91, 313. 38
Mining bureau (consolidated with bureau of science as of November 1, 1905):		
Salaries and wages	9, 237. 50	
Contingent expenses	1, 022. 06	
		10, 259. 56
Philippines civil hospital (consolidated with bureau of health as of November 1, 1905):		
Salaries and wages	23, 455. 19	
Contingent expenses	44, 976. 32	
		68, 431. 51
Civil sanitarium, Baguio (consolidated with bureau of health as of November 1, 1905):		
Salaries and wages	6, 788. 90	
Contingent expenses	9, 838. 29	
		16, 627. 19
Total for department of the interior		2, 056, 753. 90

DEPARTMENT OF COMMERCE AND POLICE.

Bureau of constabulary:		
Pay of constabulary	₱1, 957, 331. 81	
Clothing, camp and garrison equipage	432, 762. 30	
Barracks and quarters	183, 161. 58	
Transportation	354, 604. 15	
Subsistence	392, 534. 40	
Contingent expenses	74, 777. 15	
Telegraph and telephone service	46, 940. 82	
Secret service	18, 786. 71	
Commissary stores (excess of refunds)	306, 019. 26	
Land transportation sale to city of Manila (excess of refunds)	5, 745. 70	
		3, 149, 133. 96
Bureau of public works:		
Salaries and wages	180, 990. 00	
Contingent expenses	38, 605. 42	
Public works	198, 717. 97	
Maintenance, alteration, and repair of public buildings	42, 512. 17	
Public works transferred from bureau of architecture	1, 450. 00	
Purchase of supplies	50, 473. 04	
		512, 748. 60
Bureau of navigation:		
Salaries and wages	90, 000. 00	
Contingent expenses	17, 509. 60	
Cutters and launches	1, 043, 663. 95	
Light-house service	393, 676. 30	
Marine railway and repair shop (excess of refunds)	4, 917. 14	
		1, 539, 932. 71
Bureau of architecture (consolidated with bureau of public works as of November 1, 1905):		
Salaries and wages	17, 162. 53	
Contingent expenses	7, 432. 96	
Public works	20, 436. 03	
Building supplies (excess of refunds)	6, 534. 07	
Land transportation sale to city of Manila (excess of refunds)	106, 444. 70	
		67, 947. 25

Bureau of posts:		
Salaries and wages	₱530,354.60	
Contingent expenses	44,385.69	
Mail transportation	72,025.49	
Construction, maintenance, and repair of telegraph and telephone lines	332.09	
		₱647,097.87
Coast and geodetic survey:		
Salaries and wages	96,913.44	
Contingent expenses	70,591.33	
		167,504.77
Signal service:		
Salaries and wages	64,858.24	
Contingent expenses	55,577.41	
		120,435.65
Superintendent Intendencia Building (consolidated with bureau of public works as of November 1, 1905):		
Salaries and wages	1,207.11	
Contingent expenses	2,176.84	
		3,383.95
Superintendent Oriente Building (consolidated with bureau of public works as of November 1, 1905):		
Salaries and wages	1,550.00	
Contingent expenses	7,645.71	
		9,195.71
Custodian Santa Potenciana Building (consolidated with bureau of public works as of November 1, 1905):		
Salaries and wages	798.00	
Contingent expenses	246.38	
		1,044.38
Custodian Fortin Building (consolidated with bureau of public works as of November 1, 1905): Contingent expenses		1,830.63
Total for the department of commerce and police		6,084,360.98

DEPARTMENT OF FINANCE AND JUSTICE.

Bureau of justice:		
Salaries and wages	₱753,821.94	
Contingent expenses	70,011.04	
		823,832.98
Bureau of audits:		
Salaries and wages	257,952.17	
Contingent expenses	21,619.84	
Fidelity bond premiums	33,311.62	
		312,883.63
Bureau of the treasury:		
Salaries and wages	124,493.00	
Contingent expenses	11,219.23	
		135,712.23
Bureau of customs:		
Salaries and wages	798,156.15	
Contingent expenses	163,527.89	
Extra service of employees	603.65	
Operation of Manila Arrastre plant (excess of refunds)	25,295.96	
Operation of Jolo Arrastre plant (excess of refunds)	1,137.57	
Coal-supply fund (excess of refunds)	74.59	
		935,779.57

Bureau of internal revenue:		
Salaries and wages	₱332, 575. 00	
Contingent expenses	98, 291. 31	
		₱430, 866. 31
Total for the department of finance and justice		2, 639, 074. 72

DEPARTMENT OF PUBLIC INSTRUCTION.

Bureau of education:		
Salaries and wages	₱2, 366, 746. 00	
Contingent expenses	710, 550. 87	
		3, 077, 296. 87
Bureau of prisons:		
Salaries and wages	163, 968. 32	
Contingent expenses	522, 751. 48	
Manufacturing supplies	128, 262. 25	
Salaries and wages, manufacturing department	52, 371. 32	
Installation of electric light and power plant (excess of refunds)	452. 67	
Carabao cart fund	3, 261. 21	
		870, 161. 91
Bureau of supply:		
Purchase of supplies (excess of refunds)	160, 830. 49	
Salaries and wages	125, 162. 17	
Contingent expenses	39, 836. 85	
Construction of lorches	866. 95	
Land transportation sale to city of Manila (excess of refunds)	89, 256. 68	
		84, 221. 20
Bureau of printing:		
Salaries and wages	266, 780. 68	
Contingent expenses	121, 882. 93	
		388, 663. 61
Ethnological survey (consolidated with bureau of education as of November 1, 1905):		
Salaries and wages	5, 701. 78	
Contingent expenses	676. 37	
		6, 378. 15
Bureau of cold storage:		
Salaries and wages	150, 440. 29	
Contingent expenses	124, 749. 50	
Land transportation sale to city of Manila (excess of refunds)	3, 095. 77	
		272, 094. 02
American circulating library (consolidated with bureau of education as of November 1, 1905):		
Salaries and wages	1, 063. 65	
Contingent expenses	868. 67	
Refundable appropriation for purchase of books	14. 78	
		1, 947. 10
Total for department of public instruction		4, 532, 320. 46

UNASSIGNED SERVICE.

Benguet improvements (excess of refunds)		₱8,601.14
Consulting architect		9,018.80
St. Louis Exposition board		6,572.29
Chief quartermaster, Division of the Philippines:		
Contingent expenses (excess of refunds)	₱814.64	
Pay of interpreters (excess of refunds)	58.30	
Pay of scouts (excess of refunds)	452.42	
Claim for damages (excess of refunds)	585.12	
Rents and repairs	306.74	
		1,603.74
Miscellaneous indefinite appropriations:		
Contribution to the city of Manila, 30 per cent of net withdrawals		1,338,385.74
Annual payment to Sultan of Sulu and his advisers		18,245.00
Interest on public improvements bonds		220,375.00
Interest on friars' lands bonds (fourth quarter paid from friars' lands fund)		420,000.00
Miscellaneous specification appropriation:		
One-third expenses of Burnham & Anderson		1,127.90
Extra compensation to F. W. Carpenter		1,000.00
Roads and bridges, act No. 1 (excess of refunds)		8,232.55
General purposes of the insular government at Washington, D. C. (excess of refunds)		157,337.08
Pay of Cavite police		6,102.20
Maps for insular officials, act No. 807 (excess of refunds)		.01
Payment of claims at Mariquina and San Mateo on account of quarantine measures, act No. 1252		1,680.00
Reconstruction of schoolhouse at Cabanatuan, act No. 1416		250.00
Collecting librarian (excess of refunds)		12.11
San Jose College litigation expenses		1,000.00
Reimbursements to British-Manila Estates Company, act No. 1478		2,195.00
Census expenses (excess of refunds)		3,824.40
Expenses of Congressional party accompanying Secretary of War to the Philippine Islands		34,162.94
Extra compensation to W. Morgan Shuster		1,750.00
Extra compensation to C. H. Sleeper		1,375.00
Rewards to crew of steamer *Landaura*		870.00
Refund of provost fees collected at Montalban		1,100.00
Commission of 50 Filipinos visiting St. Louis		11.00
Refund of customs duties to Sultan of Sulu		482.70
Refund to Enrico Elas and others		600.00
Refund of moneys seized on island of Lubang		852.80
Refund of insurgent tax funds, Cagayan Province		30,000.00
Refund of moneys seized at Sorsogon		4,111.60
War emergency rice fund, act No. 495 (excess of refunds)		10,289.62
District commander, Isabela de Basilian (excess of refunds)		41.42
Miscellaneous appropriations, fiscal year 1901 (excess of refunds)		148.97
Dredging Santa Cruz estero (excess of refunds)		.01
Return of advance to friars' lands fund, act No. 1120 (excess of refunds)		10,000.00
Insular salary and expense fund		340,893.66

Miscellaneous specific appropriation—Continued.		
Construction of tramway, act No. 912 (excess of refunds)		₱335. 17
Purposes of act No. 1461 as to opium licenses (excess of refunds)		51, 603. 89
Naguilian-Baguio trail (excess of refunds)		1, 534. 58
Payments to provinces:		
Purchase of sailboat for Palawan Province	₱9, 000. 00	
General expenses, Mindoro Province	41, 700. 00	
General expenses, Palawan Province	14, 160. 00	
Cancellation of loans, Palawan Province	20, 269. 23	
General expenses, Benguet Province	19, 100. 10	
General expenses, Zambales Province	5, 000. 00	
General expenses, Lepanto-Bontoc Province	29, 250. 00	
General expenses, Nueva Vizcaya Province	17, 500. 00	
Outstanding indebtedness, Abra Province	14, 372. 13	
Cancellation of loans, Masbate Province	5, 000. 00	
Reimbursements to provinces of calendar year 1906, land taxes	1, 317, 694. 30	
Additional reimbursements of calendar year 1906, land taxes to Province of Cebu	16, 160. 69	
		1, 509, 206. 45
Total for unassigned service		3, 697, 803. 39

RECAPITULATION.

The Philippine Commission	79, 610. 82
Executive department	619, 492. 12
Department of the interior	2, 056, 733. 90
Department of commerce and police	6, 084, 360. 98
Department of finance and justice	2, 639, 074. 72
Department of public instruction	4, 532, 320. 46
Unassigned service	3, 697, 803. 39
Grand total carried to recapitulation sheet	19, 709, 416. 39

SCHEDULE D.

Other withdrawals.

GENERAL FUND.

Invalid money orders	577. 06
Loans to provinces	86, 095. 24
Philippines money-order fund (excess of refunds)	1, 056, 043. 08
Refundable customs export duties	71, 649. 86
Surplus on customs auction sales	3, 675. 13
Refundable internal revenue (excess of refunds)	148, 923. 92
Assurance funds (excess of refunds)	13, 408. 05
Outstanding liabilities	567. 38
Constabulary relief fund:	
Purposes of section 11, act No. 619 (excess of refunds)	10, 571. 15
Purposes of section 14, act No. 619 (excess of refunds)	68, 210. 73
Advances to provinces (excess of refunds)	2, 625. 02
Refundable land taxes, province of Rizal	674. 35
Net excess of refunds	1, 136, 542. 93

CITY OF MANILA FUND.

Municipal board:		
Salaries and wages	₱86, 211. 14	
Contingent expenses	106, 291. 42	
		₱192, 502. 56
Department of engineering and public works:		
Salaries and wages	485, 634. 82	
Contingent expenses	545, 236. 22	
Reimbursement from sewer and waterworks construction fund, act No. 1422 (excess of refunds)	227, 102. 86	
		803, 768. 18
Department of assessments and collections:		
Salaries and wages	56, 426. 64	
Contingent expenses	19, 563. 28	
Tax refunds	33, 917. 00	
		109, 906. 92
Fire department:		
Salaries and wages	240, 388. 66	
Contingent expenses	79, 507. 64	
		319, 896. 30
Law department:		
Salaries and wages	130, 817. 80	
Contingent expenses	23, 801. 68	
		154, 619. 48
Police department:		
Salaries and wages	1, 101, 862. 01	
Contingent expenses	54, 666. 40	
		1, 156, 528. 41
Department of city schools:		
Salaries and wages	256, 408. 60	
Contingent expenses	17, 907. 62	
		274, 316. 22
Department of sewer and waterworks construction: Refund of preliminary expenses, (excess of refund)		5, 476. 62
Department of sanitation and transportation:		
Salaries and wages	555, 583. 72	
Contingent expenses	316, 598. 27	
Land transportation purchase account	124, 506. 87	
Services rendered and supplies furnished (excess of refunds)	257, 084. 76	
		739, 604. 10
Public works and permanent improvements:		
Paving Calle Rosario and Escolta	2, 144. 85	
Purchase of ground and construction of markets in Sampaloc and Paco	19, 600. 04	
Construction of San Miguel Bridge	18, 661. 64	
Construction of bridge over Binondo Estero	53, 173. 11	
Repair and construction of Pasig River walls below Bridge of Spain	193, 459. 53	
Construction of Ayala Bridge	187, 024. 66	
Purchase of land	45, 009. 37	
Purchase of rights in Vitas Canal	4, 000. 00	
Purchase of mowing machines	271. 04	
Purchase of benches for parks	2, 967. 31	
Equipment for pail-cleaning service	1, 737. 90	
Construction of cement curbs	5, 544. 19	
Purchase of American mules	4, 897. 97	
Interest on sewer and waterworks construction bonds	80, 150. 00	
Annual charge for sewer and waterworks bond sinking fund	38, 740. 00	

Public improvements, etc.—Continued.		
Net refund of preliminary expenses on account of sewer and waterworks construction, act No. 1422	₱130, 747. 96	
Filling moat and other low ground belonging to city, including repairs to drains	76, 936. 97	
Widening and straightening streets	175, 111. 68	
		₱778, 682. 30
Miscellaneous:		
Luneta extension (balance of loan of ₱350,000 from insular government) (excess of refunds)		48, 000. 00
Reimbursement to Burnham and Anderson		2, 255. 80
City of Manila salary and expense fund		15, 276. 74
Total		4, 493, 880. 39

CONGRESSIONAL RELIEF FUND.

Relief to inhabitants of Batanes Island	₱1, 963. 27	
Moving municipality of Santa, Ilocos Sur	5, 000. 00	
Expenses serum investigations	27, 648. 28	
Veterinarians and inoculators	19, 735. 27	
Construction and repair of schoolhouses	229, 348. 64	
Pasacao-Nueva Caceres road (excess of refunds)	29. 14	
Cebu-Toledo road	131, 997. 04	
Relief to inhabitants of Cavite Province	20, 000. 00	
Purchase and care of carabao (excess of refunds)	160, 825. 58	
Capas-O'Donnell-Iba road	61, 456. 38	
Relief to inhabitants of Bohol Province	383. 71	
Padre Juan Villaverde trail	3, 042. 80	
Relief to inhabitants of Romblon Province	5. 52	
Bay-Tiaong road	33, 411. 19	
Relief storm sufferers in Samar Province	6, 000. 00	
Loan to Abra Province	6, 000. 00	
Assistance to schools in Bohol Province	6, 000. 00	
Relief storm sufferers in Laguna Province	5, 684. 15	
Purchase of farm animals	68, 835. 60	
Pagbilao-Atimonan road	23, 586. 93	
Relief to inhabitants of Samar and other provinces	3, 687. 12	
Extermination of locusts	5, 000. 00	
Purchase of rice (excess of refunds)	4, 086. 32	
Relief of municipality of Naguilian (excess of refunds)	80. 75	
Relief of municipality of San Mateo (excess of refunds)	422. 52	
Construction of pier at Calapan, Mindoro	6, 000. 00	
Construction of Benguet road (excess of refunds)	. 04	
Magdalena, Santa Cruz road	13, 819. 05	
Construction of dike at Tarlac	16, 000. 00	
Relief of fire sufferers in municipality of Mariquina	1, 650. 00	
Relief of fire sufferers in municipality of Bay	350. 00	
Purchase of shovels	142. 04	
Repayment of loan to province of Ilocos Sur (excess of refunds)	6, 666. 67	
Total		524, 635. 97

GOLD-STANDARD FUND.

General purposes, including purchase of silver bullion and alloy transportation, insurance, etc	₱663, 142. 23
Redemption of fourth-issue certificates of indebtedness	6, 000, 000. 00
Interest on fourth and fifth issues certificates of indebtedness	150, 225. 00
Currency given in exchange	47, 634, 395. 87
Total	54, 447, 763. 10

FRIARS' LANDS FUND.

Purchase of lands	7, 043, 314. 00
Compensation of special counsel in title investigations	11, 093. 34
Return of advance from general funds, act No. 1120	10, 000. 00
Payment of interest on bonds	141, 050. 00
Transferred to sinking fund for redemption of and payment of interest on bonds	50, 000. 00
Total	7, 255, 457. 34

FRIARS' LANDS SINKING FUND.

Transferred from friars' lands fund for redemption of and payment of interest on bonds (excess of refunds)	50, 000. 00

PUBLIC WORKS AND PERMANENT IMPROVEMENT FUND.

Improvement port of Manila and Pasig River	₱1, 525, 736. 98
Improvement port of Cebu	261, 810. 07
Improvement port of Iloilo	219, 897. 98
Improvement Pasig River front	257, 283. 75
Quarantine station at Cebu	15, 317. 61
Construction of light-houses	124, 999. 15
Improvement of Engineer's Island	10, 948. 73
Wright-Taft road	55, 000. 00
Public works, bureau of architecture and public works	65, 162. 02
Improvement of Bilibid prison and stone quarry	49, 516. 91
Calamba-Los Baños-Bay road	53, 787. 21
Maintenance of survey parties	20, 000. 00
Baguio-Trinidad road	2, 500. 00
Stone causeway and timber pier at Puerto Princesa	5, 000. 00
Benguet improvements	1, 366. 93
Loan to city of Manila	350, 000. 00
Total	3, 018, 327. 34

SEWER AND WATERWORKS CONSTRUCTION FUND.

General purposes	600, 778. 12

SEWER AND WATERWORKS BOND SINKING FUND.

Annual charge against city of Manila revenues for investment and redemption of bonds at maturity (excess of refunds)	38, 740. 00

DEPOSITARY FUND.

Withdrawals of depositary funds	129, 871, 105. 305
Grand total carried to recapitulation sheet	198, 986, 664. 635

SCHEDULE E.

Available funds for insular government administration.

GENERAL FUND.

Available for appropriation	₱2,572,268.38

UNDRAWN APPROPRIATIONS.

The executive:	
Executive bureau—	
Administrative expenses, Philippine Commission	166.68
Administrative expenses, executive	4,500.00
Administrative expenses, executive bureau	38,299.03
Bureau of civil service—Administrative expenses	5,594.60
Department of the interior:	
Bureau of health—	
Administrative expenses	120,527.87
Public works, acts Nos. 490 and 807	1,105.56
Construction of Culion leper colony	14,990.66
Civil sanitarium, Benguet—Administrative expenses	75.00
Bureau of lands—Administrative expenses	15,000.00
Bureau of science—	
Administrative expenses	57,775.89
Purchase of books	2,960.80
Bureau of agriculture—Administrative expenses	60,511.52
Bureau of forestry—Administrative expenses	1,839.14
Quarantine service—Administrative expenses	30,204.94
Weather bureau—Administrative expenses	8,499.83
Department of commerce and police:	
Signal service—Administrative expenses	3,858.50
Bureau of constabulary—	
Administrative expenses	196,278.51
Commissary stores	136,334.15
Bureau of public works—	
Administrative expenses	28,175.26
Public works, including maintenance, alteration, and repair of public buildings and purchase of building supplies	47,277.08
Bureau of navigation—	
Administrative expenses	42,420.85
Marine railway and repair shop	29,917.14
Bureau of posts—Administrative expenses	427,590.92
Bureau of coast and geodetic survey—Administrative expenses	6,938.98
Department of finance and justice:	
Bureau of customs—	
Administrative expenses	13,725.25
Extra services of employees	1,748.24
Services of officers in private bonded warehouses	283.85
Operation of Manila Arrastre plant	61,635.14
Operation of Jolo Arrastre plant	2,314.65
Coal-supply fund	74.59
Bureau of justice—Administrative expenses	16,073.53
Bureau of audits—Administrative expenses	7,503.78
Fidelity bond premiums	66,688.38
Bureau of internal revenue—Administrative expenses	55,759.71
Bureau of the treasury—Administrative expenses	3,485.34
Department of public instruction:	
Bureau of prisons—	
Administrative expenses	60,652.94
Carabao-cart fund (overdraft)	3,298.71
Installation of electric light and power plant	452.67
Bureau of education—	
Administrative expenses	1,868.72
Purchase of books, library division	3,508.13

Department of public instruction—Continued.	
Bureau of supply—	
Administrative expenses	₱3.32
Purchase of supplies	397,143.35
Bureau of printing—Administrative expenses	74,308.92
Bureau of cold storage—Administrative expenses	59,291.41
Unassigned service:	
St. Louis Exposition board—Exposition expenses	9,934.26
Benguet improvements, general purposes	14,560.52
Miscellaneous—	
Roads and bridges, act No. 1	25,588.40
General purposes of the insular government	22,521.70
One-third expense, Burnham and Anderson	1,220.88
Old transportation claims	1,119.72
San Jose litigation	1,876.27
Registry of property at Cebu	200.00
Consulting architect	981.20
Expenses of official party accompanying Secretary of War to the Philippine Islands	10,797.06
Pay of Cavite police	97.80
Reimbursement to provinces of land taxes for the calendar year 1906	1,340,874.94
Purchase of Formosa eggs	700.00
Purposes of act No. 1461 as to proceeds of opium licenses	51,603.89
Reimbursement to municipality of Borongan, Samar	493.95
Interest on public improvement bonds (overdraft)	375.00
Additional reimbursement of land taxes for calendar year 1906 to province of Cebu	16,160.76
Total undrawn appropriations	3,602,422.47
Grand total carried to recapitulation sheet	6,174,690.85

SCHEDULE F.

Other funds.

GENERAL FUND.

Undrawn refundable appropriations:	
Invalid money orders	4,447.74
Surplus on customs auction sales	495.84
Refundable customs export duties	799,667.62
Outstanding liabilities	6,955.74
Assurance fund	13,408.05
Refundable internal revenue	596,266.46
Constabulary relief fund—	
Purposes of section 11, act No. 619	10,571.15
Purposes of section 14, act No. 619	68,210.73
Philippine money-order funds	1,056,043.08
Total	2,556,066.41

Special funds.

CITY OF MANILA FUND.

Available for appropriation (overdraft)	1,357,516.95
Undrawn appropriations:	
Municipal board—Administrative expenses	1,948.53
Department of sanitation and transportation—Administrative expenses	42,402.77
Department of assessment and collections—Administrative expenses	404.57
Fire department—Administrative expenses	5,736.41
Law department—Administrative expenses	2,239.14
Police department—Administrative expenses	3,279.53
Department of city schools—Administrative expenses	86

Undrawn appropriations—Continued.	
Department of engineering and public works—Administrative expenses	₱15, 420. 20
Public works and permanent improvements, city of Manila—	
Purchase of ground for Paco market	399. 96
Construction of Ayala bridge	27, 573. 28
Construction and repair of Pasig River walls below the Bridge of Spain	142, 540. 47
Widening and straightening streets generally	21, 756. 60
Miscellaneous—	
Reimbursement to D. H. Burnham	2, 441. 76
Luneta extension	48, 000. 00
City of Manila salary and expense fund	19, 720. 92
Land transportation purchase account (overdraft)	106, 567. 24
Total	227, 297. 76
Net overdraft	1, 130, 219. 19

CONGRESSIONAL RELIEF FUND.

Available for appropriation	107, 495. 24
Undrawn appropriation:	
Pasacao-Nueva Caceres road, act No. 918	29. 14
Pagbilao-Atimonan road, act No. 1015	15. 00
Capas-O'Donnell-Iba road, act No. 1016	4, 941. 21
Bay-Tiaong road, act No. 1073	2, 455. 99
Magdalena-Santa Cruz road, act No. 1073	1, 180. 95
Lucena-Sariaya road, act No. 1073	8, 697. 31
Calamba-Los Banos road, act No. 1074	198. 80
Construction of school buildings, act No. 1275	95, 190. 07
Naguilian relief fund, act No. 1305, resolution of April 27, 1905	80. 75
Purchase of farm animals, act No. 1305, resolution of June 13, 1905	3, 087. 20
Cebu-Toledo road, act No. 1329	27, 905. 06
Veterinarians and inoculators, act No. 1198, resolution of July 27, 1904	20, 403. 85
Veterinarians and inoculators, act No. 1198, resolution of August 3, 1904	33. 37
Purchase of plowing engine, act No. 1198, resolution of August 4, 1904	577. 18
Purchase of palay seed, act No. 1198, resolution of September 12, 1904	1, 800. 00
Veterinarians and inoculators, act No. 797, resolution of July 27, 1903	1, 270. 43
Purchase of serum cattle, act No. 797, resolution of July 28, 1903	10, 602. 10
Care of carabao, act No. 797, resolution of August 18, 1903	1, 665. 41
Care of carabao, act No. 797, resolution of September 7, 1903	122. 08
Care of carabao, act No. 797, resolution of February 16, 1905	2, 273. 93
Relief to inhabitants of Lumban, act No. 797, resolution of February 25, 1905	250. 00
Relief to inhabitants of San Mateo, Rizal, act No. 797, resolution of February 15, 1905	422. 52
Purchase of 1,000 sacks of rice, act No. 797, resolution of October 3, 1905	315. 85
Care of carabao, act No. 1046, resolution of February 25, 1904	1, 144. 00
Veterinarians and inoculators, act No. 1046, resolution of February 26, 1904	19. 22
Expenses serum laboratory, act No. 1046, resolution of February 27, 1904	1, 273. 03

Undrawn appropriations—Continued.		
Purchase of rice, act No. 1046, resolution of February 20, 1904		₱2, 915. 94
Purchase of animals, act No. 1046, resolution of May 3, 1904		. 77
Relief to inhabitants of Batanes Islands, act No. 1406, resolution of January 15, 1906		836. 73
Relief of Samar Province, act No. 1406, resolutions of September 29, and October 20, 1905		6, 312. 88
Cattle for serum laboratory, act No. 1350, resolution of June 23, 1905		1, 759. 55
Relief of Bohol Province, act No. 1350, resolution of June 16, 1905		1, 616. 29
Locust pest, Romblon Province, act No. 1350, resolution of July 24, 1905		244. 48
Purchase of farm animals, act No. 1350, resolution of June 13, 1905		37, 481. 53
Completing the construction and repair of the Pagbilao-Atimonan road, act No. 1406, resolution of December 27, 1905		37, 121. 10
Subject to resolution, act No. 1406		101, 824. 00
		376, 067. 72
Total		483, 562. 96

GOLD STANDARD FUND.

Available for appropriation		3, 128, 836. 14
Undrawn appropriations: General purposes		2, 624, 334. 95
Total		5, 753, 171. 09

FRIARS' LANDS FUND.

Available for appropriation and sinking fund purposes		48, 661. 30
Undrawn appropriations:		
General purposes of act No. 1238 (surplus of bond issue)	₱1, 024, 656. 98	
Sinking fund for redemption of and payment of interest on bonds	50, 000. 00	
		1, 074, 656. 98
Total		1, 123, 318. 28

PUBLIC WORKS AND PERMANENT IMPROVEMENTS FUND.

Available for appropriation		390, 274. 00
Undrawn appropriation:		
Calamba-Los Baños road	₱5, 812. 79	
Stone causeway at Puerta Princesa	5, 000. 00	
Wright-Taft road	5, 000. 00	
Manila Harbor and Pasig River	1, 123, 539. 16	
Port of Cebu	947, 683. 85	
Port of Iloilo	176, 001. 15	
Improvement Pasig River front	1, 046. 65	
Light-house construction	25, 197. 59	
Improvement of Engineers Island	15, 060. 75	
Marine railway and machine shop, Engineers Island	1, 774. 80	
Improvement Bilibid prison and stone quarry	54, 592. 92	
Benguet improvement	327. 89	
Quarantine station at Cebu	2, 905. 54	
Public works, bureau of public works, transferred from former bureau of architecture	38, 044. 45	
Maintaining two survey parties	16, 000. 00	
		2, 417, 987. 54
Total		2, 808, 261. 54

SEWER AND WATERWORKS CONSTRUCTION FUND.

Available for appropriation		₱1,425,150.00
Undrawn appropriations:		
General purposes	₱165,321.88	
Sinking fund for redemption of bonds	38,740.00	
		204,061.88
Total		1,629,211.88

DEPOSITARY FUNDS.

Available for refundment	₱11,218,498.70

SILVER CERTIFICATE RESERVE FUND.

Available for redemption	₱14,410,000.00
Grand total carried to recapitulation sheet	38,851,871.67

THE INSULAR TREASURER'S CASH ACCOUNT.

The following statements show the various cash transactions at the insular treasury during the fiscal year, by months, as audited. The new Philippines currency having a fixed and permanent value in its relation to United States currency at the ratio of 2 to 1, the accounts as stated in Philippines currency includes all transactions in United States currency on that basis.

Under existing laws all receipts are deposited in the insular treasury without deduction, and all withdrawals are made by warrant. The statements embrace all transactions during the fiscal year 1906, without reference to the period for which the deposited collections were made and also without reference to the service for which funds were withdrawn for expenditure.

The cash balance in the hands of the insular treasurer includes the sum of warrants outstanding and not presented for payment on June 30, 1906. This sum as shown under account of "Outstanding warrants" added to the balance shown under Treasury account will equal the treasurer's cash balance as here shown.

There is also appended a recapitulation of the fiscal year's transactions, and a comparative treasury statement covering the fiscal years 1899 to 1906, inclusive.

Cash transactions of the insular treasurer for the fiscal year ended June 30, 1906.

JULY, 1905.

Item.	Philippine currency.	Mexican and Spanish-Filipino currency.
DEBIT.		
Balance due government July 1, 1905, including depositary and silver certificates reserve fund	₱49,815,774.37	145,465.92
Receipts on account of—		
Customs revenue	1,426,270.72	
Postal revenne	73,913.07	
Internal revenue	717,823.06	
Miscellaneous revenue	311,115.93	
New Philippines coin	169,200.00	
Premium on New York drafts	8,801.48	
City of Manila revenue	246,207.78	
Payments and repayments to appropriations	658,047.95	
Currency received in exchange	2,979,991.88	86,385.57
Depositary funds	11,696,302.30	
Silver certificates reserve	40,000.00	
	18,327,674.17	
Total	68,143,448.54	231,851.49
CREDIT.		
Withdrawals on account of—		
Settlement and accountable warrants paid	3,207,422.36	100,000.00
Currency given in exchange	3,032,181.86	17,500.00
Depositary funds	11,005,190.71	95.60
Total withdrawals	17,244,794.93	117,595.60
Balance due government July 31, 1905	50,898,653.61	114,255.89
Total	68,143,448.54	231,851.49

Cash transactions of the insular treasurer for the fiscal year ended June 30. 1906—Cont'd.

AUGUST, 1905.

Item.	Philippine currency.	Mexican and Spanish-Filipino currency.
DEBIT.		
Balance due government Aug. 1, 1905	₱50,898,653.61	114,255.89
Receipts on account of—		
Customs revenue	1,216,134.92	
Postal revenue	62,583.85	
Internal revenue	509,976.60	
Miscellaneous revenue	118,100.78	
Premium on New York drafts	17,401.75	
City of Manila revenue	90,079.43	
Payments and repayments to appropriations	742,277.55	
Currency received in exchange	4,528,520.50	198,395.70
Depositary funds	12,722,576.76	
	20,007,652.14	
Total	70,906,305.75	312,651.59
CREDIT.		
Withdrawals on account of—		
Settlement and accountable warrants paid	9,207,042.91	150,000.00
Currency given in exchange	4,664,741.06	21,300.00
Depositary funds	13,123,726.59	408.63
Total withdrawals	26,995,510.56	171,708.63
Balance due government Aug. 31, 1905	43,910,795.19	140,942.96
Total	70,906,305.75	312,651.59

SEPTEMBER, 1905.

DEBIT.		
Balance due government Sept. 1, 1905	₱43,910,795.19	140,942.96
Receipts on account of—		
Customs revenue	1,473,192.45	
Postal revenue	82,899.30	
Internal revenue	508,531.43	
Miscellaneous revenue	135,081.74½	
New Philippines coin	804,000.00	
Premium on New York drafts	13,710.50	
Proceeds from sale of fifth series certificates of indebtedness	3,049,200.00	
City of Manila revenue	119,836.06	
Payments and repayments to appropriations	921,460.61	
Currency received in exchange	3,138,757.01	134,956.22
Depositary funds	9,144,796.44	
	19,391,465.54½	
Total	63,302,260.73½	275,899.18
CREDIT.		
Withdrawals on account of—		
Settlement and accountable warrants paid	3,326,684.54	125,000.00
Currency given in exchange	3,229,433.10	14,900.00
Depositary funds	9,103,442.68	2.97
Total withdrawals	15,659,560.32	139,902.97
Balance due government Sept. 30, 1905	47,642,700.41½	135,996.21
Total	63,302,260.73½	275,899.18

Cash transactions of the insular treasurer for the fiscal year ended June 30, 1906—Cont'd.

OCTOBER, 1905.

Item.	Philippine currency.	Mexican and Spanish-Filipino currency.
DEBIT.		
Balance due government Oct. 1, 1905	₱47,642,700.41½	135,996.21
Receipts on account of—		
Customs revenue	1,215,269.56	
Postal revenue	105.00	
Internal revenue	518,204.83	
Miscellaneous revenue	127,577.53	
New Philippines coin	222,000.00	
Premium on New York drafts	12,080.46	
City of Manila revenue	154,391.73	
Payments and repayments to appropriations	785,981.44	
Currency received in exchange	3,681,124.68	77,910.90
Depositary funds	10,963,151.08	
Silver certificates reserve	500,000.00	
	18,179,886.31	77,910.90
Total	65,822,586.72½	213,907.11
CREDIT.		
Withdrawals on account of—		
Settlement and accountable warrants paid	9,899,545.48	
Currency given in exchange	3,735,456.08	5,900.00
Depositary funds	10,075,969.26	806.17
Total withdrawals	23,710,970.82	6,706.17
Balance due government Oct. 31, 1905	42,111,615.90½	207,200.94
Total	65,822,586.72½	213,907.11

NOVEMBER, 1905.

DEBIT.		
Balance due government Nov. 1, 1905	₱42,111,615.90½	207,200.94
Receipts on account of—		
Customs revenue	1,038,756.99	
Internal revenue	384,705.52	
Miscellaneous revenue	271,856.74	
New Philippines coin	160,000.00	
Premium on New York drafts	18,737.14	
City of Manila revenue	99,638.03	
Payments and repayments to appropriations	731,484.96	
Currency received in exchange	5,435,859.99	95,485.85
Depositary funds	9,916,987.88½	
Silver certificates reserve	560,000.00	
	18,618,027.25½	
Total	60,729,643.16	302,686.79
CREDIT.		
Withdrawals on account of—		
Settlement and accountable warrants paid	2,471,138.49	152,000.00
Currency given in exchange	5,495,860.76	13,812.93
Depositary funds	10,485,853.02	
Total withdrawals	18,452,852.27	165,812.93
Balance due government Nov. 30, 1905	42,276,790.89	136,873.86
Total	60,729,643.16	302,686.79

Cash transactions of the insular treasurer for the fiscal year ended June 30, 1906—Cont'd.

DECEMBER, 1905.

Item.	Philippine currency.	Mexican and Spanish-Filipino currency.
DEBIT.		
Balance due government Dec. 1, 1905	₱42,276,790.89	136,873.86
Receipts on account of—		
Customs revenue	1,104,771.38	
Internal revenue	418,516.78	
Miscellaneous revenue	109,895.81	
New Philippines coin	96,000.00	
Premium on New York drafts	10,387.45	
City of Manila revenue	386,997.57	
Payments and repayments to appropriations	1,661,520.86	
Currency received in exchange	2,850,442.78	64,119.29
Depositary funds	9,924,690.41	
Silver certificates reserve	50,000.00	
	16,613,223.04	
Total	58,890,013.93	200,993.15
CREDIT.		
Withdrawals on account of—		
Settlement and accountable warrants paid	3,835,206.41	50,000.00
Currency given in exchange	2,888,112.36	11,821.30
Depositary funds	8,849,869.96½	
Total withdrawals	15,573,188.73½	61,821.30
Balance due government Dec. 31, 1905	43,316,825.19½	139,171.85
Total	58,890,013.93	200,993.15

JANUARY, 1906.

DEBIT.		
Balance due government Jan. 1, 1906	₱43,316,825.19½	139,171.85
Receipts on account of—		
Customs revenue	1,274,181.42	
Internal revenue	548,670.64½	
Miscellaneous revenue	198,581.80	
Premium on New York drafts	13,298.68	
City of Manila revenue	240,500.15	
Payments and repayments to appropriations	1,243,590.71½	
Currency received in exchange	4,604,510.84	74,832.89
Depositary funds	10,954,606.86½	
Silver certificates reserve	400,000.00	
	19,477,941.11½	
Total	62,794,766.31	214,004.74
CREDIT.		
Withdrawals on account of—		
Settlement and accountable warrants paid	3,721,265.88	70,070.00
Currency given in exchange	4,654,454.30	7,632.12
Depositary funds	11,178,258.35	
Total withdrawals	19,553,978.53	77,702.12
Balance due government Jan. 31, 1906	43,240,787.78	136,302.62
Total	62,794,766.31	214,004.74

Cash transactions of the insular treasurer for the fiscal year ended June 30, 1906—Cont'd.

FEBRUARY, 1906.

Item.	Philippine currency.	Mexican and Spanish-Filipino currency.
DEBIT.		
Balance due government Feb. 1, 1906	₱43,240,787.78	136,302.62
Receipts on account of—		
Customs revenue	1,083,302.98	
Postal revenue	66,531.57	
Internal revenue	354,398.29	
Miscellaneous revenue	394,762.56	
New Philippines coin	138,781.80	
Premium on New York drafts	784.28	
Proceeds of second issue public improvement bonds	2,167,494.00	
City of Manila revenue	89,571.67	
Payments and repayments to appropriations	626,496.55	
Currency received in exchange	2,963,776.42	8,447.93
Depositary funds	10,338,201.09	
Silver certificates reserve	1,150,000.00	
	19,374,102.21	
Total	62,614,889.99	144,750.55
CREDIT.		
Withdrawals on account of—		
Settlement and accountable warrants paid	2,948,285.83	
Currency given in exchange	2,967,721.87	2,774.47
Depositary funds	11,075,138.53	
Total withdrawals	16,991,146.23	2,774.47
Balance due government Feb. 28, 1906	45,623,743.76	141,976.08
Total	62,614,889.99	144,750.55

MARCH, 1906.

Item.	Philippine currency.	Mexican and Spanish-Filipino currency.
DEBIT.		
Balance due government Mar. 1, 1906	₱45,623,743.76	141,976.08
Receipts on account of—		
Customs revenue	1,505,593.80	
Internal revenue	477,689.98	
Miscellaneous revenue	172,189.77	
New Philippines coin	50,000.00	
Premium on New York drafts	11,265.51	
City of Manila revenue	110,796.56	
Payments and repayments to appropriations	695,211.91	
Currency received in exchange	4,136,561.51	47,116.30
Depositary funds	12,385,189.08	
	19,544,498.12	
Total	65,168,241.88	189,092.38
CREDIT.		
Withdrawals on account of—		
Settlement and accountable warrants paid	3,567,772.57	26,637.00
Currency given in exchange	4,167,003.10	6,191.90
Depositary funds	12,496,772.88	
Total withdrawals	20,231,548.55	32,828.90
Balance due government Mar. 31, 1906	44,936,693.33	156,263.48
Total	65,168,241.88	189,092.38

Cash transactions of the insular treasurer for the fiscal year ended June 30, 1906—Cont'd.

APRIL, 1906.

Item.	Philippine currency.	Mexican and Spanish-Filipino currency.
DEBIT.		
Balance due government Apr. 1, 1906	₱44,936,693.33	156,263.48
Receipts on account of—		
Customs revenue	1,059,912.44	
Internal revenue	442,099.95	
Miscellaneous revenue	177,612.51	
New Philippines coin	66,000.00	
Premium on New York drafts	12,814.80	
City of Manila revenue	128,685.34	
Payments and repayments to appropriations	707,209.51	
Currency received in exchange	4,473,186.02	11,896.72
Depositary funds	10,464,366.16	
Silver certificates reserve	360,000.00	
	17,891,886.73	
Tota	62,828,580.06	168,160.20
CREDIT.		
Withdrawals on account of—		
Settlement and accountable warrants paid	3,329,861.02	40,000.00
Currency given in exchange	4,482,337.27	
Depositary funds	10,653,733.85	
Total withdrawals	18,465,932.14	40,000.00
Balance due government Apr. 30, 1906	44,362,647.92	128,160.20
Total	62,828,580.06	168,160.20

MAY, 1906.

DEBIT.		
Balance due government May 1, 1906	₱44,362,647.92	128,160.20
Receipts on account of—		
Customs revenue	1,164,709.73	
Postal revenue	8,982.47	
Internal revenue	365,976.34	
Miscellaneous revenue	456,713.49½	
New Philippines coin	24,000.00	
Premium on New York drafts	4,403.80	
City of Manila revenue	123,444.34	
Payments and repayments to appropriations	2,390,919.36	
Currency received in exchange	3,499,181.45	23,709.07
Depositary funds	10,666,051.10½	
Silver certificates reserve	760,000.00	
	19,464,382.09	
Total	63,827,030.01	151,869.27
CREDIT.		
Withdrawals on account of—		
Settlement and accountable warrants paid	2,721,520.94	
Currency given in exchange	3,512,997.00	4,422.65
Depositary funds	12,362,169.34	
Total withdrawals	18,596,687.28	4,422.65
Balance due government May 31, 1906	45,230,342.73	147,446.62
Total	63,827,030.01	151,869.27

Cash transactions of the insular treasurer for the fiscal year ended June 30, 1906—Cont'd.

JUNE, 1906.

Item.	Philippine currency.	Mexican and Spanish-Filipino currency.
DEBIT.		
Balance due government June 1, 1906	₱45,230,342.73	147,446.62
Receipts on account of—		
Customs revenue	1,265,952.26	
Internal revenue	442,953.19	
Miscellaneous revenue	307,127.23	
Premium on New York drafts	16,543.00	
City of Manila revenue	634,085.21	
Payments and repayments to appropriations	1,198,507.75	
Currency received in exchange	4,708,043.64	18,502.80
Depositary funds	9,209,038.62	
Silver certificates reserve	140,000.00	
	17,922,250.90	
Total	63,152,593.63	165,949.42
CREDIT.		
Withdrawals on account of—		
Settlement and accountable warrants paid	3,950,639.15	31,800.00
Currency given in exchange	4,722,016.06	450.00
Depositary funds	9,459,969.84	
Total withdrawals	18,132,625.05	32,250.00
Balance due government June 30, 1906	45,019,968.58	133,699.42
Total	63,152,593.63	165,949.42

Recapitulation of the cash transactions of the insular treasurer for the fiscal year ended June 30, 1906.

Item.	Philippines currency.	Mexican and Spanish-Filipino currency.
DEBIT.		
Balance due government July 1, 1905, including depositary and silver certificates reserve funds	₱49,815,774.37	145,465.92
Receipts on account of—		
Customs revenue	14,828,048.65	
Postal revenue	295,015.26	
Internal revenue	5,689,546.61½	
Miscellaneous revenue	2,780,616.90	
New Philippines coin	1,729,981.80	
Premium on New York drafts	140,228.85	
Proceeds sale fifth series certificates of indebtedness	3,049,200.00	
Proceeds sale second issue public improvement bonds	2,167,494.00	
City of Manila revenue	2,424,233.87	
Payments and repayments to appropriations	12,362,709.16½	
Currency received in exchange	46,999,956.72	841,759.24
Depositary funds	128,385,957.79½	
Silver certificates reserve	3,960,000.00	
	224,812,989.62½	
Total	274,628,763.99½	987,225.16
CREDIT.		
Withdrawals on account of—		
Settlement and accountable warrants paid	52,186,385.58	745,507.00
Currency given in exchange	47,552.314.82	106,705.37
Depositary funds	129,870,095.01½	1,313.37
Total withdrawals	229,608,795.41½	853,525.74
Balance due government June 30, 1906	45,019,968.58	133,699.42
Total	274,628,763.99½	987,225.16

Analysis of insular treasurer's cash balance on June 30, 1906.

	Philippines currency.	Mexican and Spanish-Filipino currency.
General account	₱19,392,404.64	132,484.23
Depositary funds	11,217,563.94	1,215.19
Silver certificates reserve	14,410,000.00	....
Total	45,019,968.58	133,699.42

Reducing the Mexican and Spanish-Filipino currency to a Philippines currency, equivalent at the ratio of 1.30 to 1, will result in a cash balance in the hands of the insular treasurer, expressed in Philippines currency of ₱45,122,814.29, equivalent to $27,561,407.14½ United States currency.

COMPARATIVE TREASURY STATEMENT, FISCAL YEARS 1899–1906.

The following is a comparative statement of cash transactions at the insular treasury by fiscal years from the date of American occupation, in August, 1898, to June 30, 1906, expressed in Philippine currency. The treasurer's account for the fiscal year 1906, elsewhere stated in the currencies actually involved, is here, for the purpose of comparison, converted at the ratio of 1.30 to 1, the official ratio at the close of the fiscal year. From this statement has been excluded the sum of $455,093.49, the estimated United States currency value of seized funds in the treasury, as a part of the treasurer's balance until June 30, 1901, at which time the funds were taken over to a special account, and taken up later in the treasurer's general account as the items were sold and became available.

Comparative treasury statement, fiscal years 1899–1906.

Item.	Fiscal year ended June 30—							
	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
DEBIT.								
Balance due government beginning of the year		₱738, 959. 02	₱4, 046, 834. 76	₱12, 445, 825. 56	₱11, 990, 012. 99	₱21, 267, 386. 26	₱32, 991, 123.18	₱26, 774, 025. 03
Transferred from depositary and silver certificates reserve account								23, 153, 646. 20
Total deposits on account of—								
Customs revenue	₱6, 167, 300. 90	11, 364, 530. 42	18, 254, 010. 04	16, 816, 170. 75	18, 354, 758. 80	17, 453, 884. 74	16, 398, 051. 45	14, 828, 048. 65
Postal revenue		36, 000. 00	190, 031. 24	200, 434. 68	206, 716. 88	280, 799. 71	249, 568. 14	295. 015. 26
Internal revenue	490, 430. 16	1, 045, 151. 32	1, 864, 969. 82	536, 222. 58	425, 662.18	560, 675. 07	4, 047, 578. 70	5, 689, 546. 62
Miscellaneous revenue	269, 432. 52	1, 091, 738. 84	1, 324, 449. 52	1, 203, 502. 20	2, 350, 840. 88	2, 212, 545. 73	2, 172, 893. 62	2, 780, 616. 90
City of Manila revenue				2, 135, 743. 25	3, 154, 832. 98	3, 875, 612. 22	2, 903, 918. 52	2, 424, 233. 87
Payments and repayments to appropriations			893, 173. 52	6, 560, 138. 16	9, 171, 991. 38	10, 737, 681. 03	9, 809, 518. 47	12, 362, 709. 16
Philippine pesos coined from bullion purchased					3, 200, 000. 00	16, 641, 494. 56	12, 142, 546. 00	1, 729, 981. 80
Premium on New York drafts							43, 785. 00	140, 228. 85
Proceeds from sale of certificates of indebtedness and premium thereon					6, 150, 780. 00	12, 205, 260. 00	6, 084, 600. 00	3, 049, 200. 00
Proceeds from sale of public works and permanent improvement bonds							5, 460, 608. 70	2, 167, 494. 00
Proceeds from sale of Manila water-supply and sewerage bonds, issue of ₱2,000,000							2, 191, 250. 00	
Relief fund voted by United States Congress					6, 000, 000. 00			
Sale of friar-land bonds and premium thereon						15, 060, 780. 00		
Currency received in exchange								47, 647, 463. 83
Depositary funds								128, 385, 957. 79
Silver certificates reserve								3, 960, 000. 00
Total debit	6, 927, 163. 58	14, 276, 379. 60	26, 573, 468. 90	39, 898, 037. 16	61, 005, 596. 09	100, 296, 119. 32	94, 495, 441. 78	275, 388, 167. 96
CREDIT.								
Withdrawals on settlement and accountable warrants	6, 188, 204. 56	10, 229, 544. 84	14, 127, 643. 34	26, 722, 641. 41	39, 056, 676. 04	67, 261, 305. 44	66, 845, 332. 77	52, 759, 852. 50
Allowance under rule 28, act No. 90							615. 18	
Total net differences due to change of official rates of exchange in conversion of Mexican to Philippine currency				1, 185, 382. 76	681, 533. 79	43, 690. 70	875, 468. 80	
Currency given in exchange								47, 634, 395. 87
Depositary funds								129, 871, 105. 30
Balance due government at close of year	738, 959. 02	4, 046, 834. 76	12, 445, 825. 56	11, 990, 012. 99	21, 267, 386. 26	32, 991, 123. 18	26, 774, 025. 03	45, 122, 814. 29
Total credit	6, 927, 163. 58	14, 276, 379. 60	26, 573, 468. 90	39, 898, 037. 16	61, 005, 596. 09	100, 296, 119. 32	94, 495, 441. 78	275, 388, 167. 96

INSULAR REVENUES AND EXPENDITURES.

Following is a statement, by departments, bureaus, and offices, of the revenues and expenditures of the insular government, arranged in such form as to show the gross receipts of each bureau having sources of revenue, the refunds of such revenues, and the net revenues, as well as the gross expenditures, the refunds of such expenditures, and the net expenditures. Following out this computation, the excess of revenue over expenditure or the excess of expenditure over revenue, as the case may be, in every bureau and branch of the insular service is carried out in the last two columns. Many of the insular bureaus have no sources of revenue whatever, but this method of stating the fiscal affairs affords a convenient means of comparing revenues and disbursements and a complete showing of the net results without resorting to further computation.

Revenues are shown under the particular sources from which derived, and expenditures are stated for the general purpose for which made under the digest headings shown in the appropriation acts. Salaries and wages specifically appropriated for as such are included under that general heading. Contingent expenses include those necessary expenditures in the conduct of a business or office which are not provided for under salaries and wages and include expenses for transportation of supplies and travel on official business, purchase of furniture, stationery, supplies, telegrams, cablegrams, rents, ice, etc.

All expenditures from funds derived from bond issues or from funds for public works or special purposes and not pertaining to the administrative cost of conducting a bureau are excluded from the regular statement of revenues and expenditures of the bureau concerned, as the funds from which such expenditures were made were not derived from regular sources of revenue and the expenditures therefrom being for extraordinary purposes.

PHILIPPINE COMMISSION.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Salaries and wages				₱77,501.01		₱77,501.01		₱77,501.01
Total						77,501.01		77,501.01

THE EXECUTIVE.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Salaries and wages				₱104,500.00		₱104,500.00		₱104,500.00
Executive bureau:								
Sales of public documents	₱2,251.14							
Registry fees, copyrights, and trade-marks	7,040.35							
Total	9,291.49		₱9,291.49					
Salaries and wages				284,299.75	₱13.34	284,286.41		
Contingent expenses				157,796.06	10,549.22	147,246.84		
Total			9,291.49	442,095.81	10,562.56	431,533.25		442,241.76
Philippine civil service board:								
Salaries and wages				66,353.90		66,353.90		
Contingent expenses				7,526.63	6.24	7,520.39		
Total				73,880.53	6.24	73,874.29		73,874.29
Official Gazette (consolidated with executive bureau, as of Nov. 1, 1905):								
Subscriptions to Official Gazette	2,566.20		2,566.20					
Salaries and wages				3,122.55		3,122.55		556.35
Bureau of Insular Affairs, Washington, D. C.:								
Sale of documents	18,00		18.00					
General purposes of the insular government at Washington, D. C				56,801.48	358.66	56,442.82		
Total			18.00	55,801.48	358.66	56,442.82		56,424.82

Bureau of Archives (consolidated with executive bureau as of Nov. 1, 1905):								
Salaries and wages				7,160.00		7,160.00		
Contingent expenses				60.43		60.43		
Total				7,220.43		7,220.43		7,220.43
Total for bureaus under the executive			11,875.69			676,693.34		664,817.65

DEPARTMENT OF FINANCE AND JUSTICE.

Bureau of the treasury:								
Sales of property	₱178.70							
Sales of provincial books and forms	3,502.23							
Sales of cattle registration stamps	129.82							
Total	3,810.75		₱3,810.75					
Salaries and wages				₱127,510.52	₱47.21	₱127,463.31		
Contingent expenses				27,723.80	16,609.62	11,114.18		
Total			3,810.75	155,234.32	16,656.83	138,577.49		₱134,766.74
Bureau of audits:								
Salaries and wages				269,686.24	1,711.11	267,975.13		
Contingent expenses				21,668.81	440.08	21,228.73		
Fidelity bond premiums				78,174.48	51,451.54	26,722.94		
Total				369,529.53	53,602.73	315,926.80		315,926.80
Bureau of justice:								
Notarial and judicial fees	197,035.99½							
Cost recovered in court cases	136.00							
Sales of publications	308.45							
Court of land registration fees	37,616.28							
Forfeiture of bonds for loss firearms	400.00							
Total	235,496.72½		235,496.72½					
Salaries and wages				759,829.39	350.00	759,479.39		
Contingent expenses				67,008.35	568.80	66,439.55		
Total			235,496.72½	826,837.74	918.80	825,918.94		590,422.21½

DEPARTMENT OF FINANCE AND JUSTICE—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Bureau of internal revenue:								
Provinces—		*Refundable.*						
Albay	₱146,310.06	₱36,577.52						
Ambos Camarines	123,577.27	30,894.32						
Antique	3,181.89	795.47						
Bataan	22,431.58	5,607.89						
Batangas	26,560.00	6,640.00						
Benguet	3,238.71	809.68						
Bohol	9,627.39	2,406.85						
Bulacan	323,197.63	80,799.41						
Cagayan	73,750.32	18,437.58						
Capiz	17,360.66	4,340.16						
Cavite	22,968.53	5,742.13						
Cebu	131,512.76	32,878.19						
Ilocos Norte	12,111.45	3,027.86						
Ilocos Sur	62,526.50	15,631.63						
Iloilo	132,803.78	33,200.94						
Isabela	14,849.96	3,712.49						
Laguna	73,240.51	18,310.13						
Lepanto-Bontoc	406.10	101.52						
Leyte	112,266.92	28,066.73						
Masbate	4,322.15	1,080.54						
Mindoro	5,486.89	1,371.72						
Misamis	34,195.46	8,548.87						
Moro	70,593.20	17,648.30						
Nueva Ecija	16,693.48	4,173.37						
Nueva Vizcaya	806.73	201.68						
Occidental Negros	44,623.59	11,155.90						
Oriental Negros	12,638.91	3,159.73						
Pampanga	174,409.30	877.61						
Palawan	3,510.46	52,837.98						
Pangasinan	211,351.93	43,602.32						
Rizal	51,294.89	12,823.72						
Romblon	12,737.14	3,184.29						
Samar	55,784.18	13,946.05						
Sorsogon	69,607.48	17,401.87						
Surigao	32,054.74	8,013.68						
Tarlac	47,211.09	11,802.77						
Tayabas	42,067.81	10,516.95						
Union	15,560.07	3,890.02						
Zambales	10,048.20	2,512.05						

City of Manila	4,616,594.59	1,154,148.65						
Erroneous collections refunded to taxpayers		1,845.02						
Total	6,843,514.31	1,712,723.59	5,130,790.72					
Salaries and wages				329,263.71				
Contingent expenses				101,789.39				
Total			5,130,790.72	431,053.10		431,053.10	4,699,737.62	
Bureau of customs:								
Port of Manila—								
Duties on merchandise imported for immediate consumption	9,328,396.40	Refund.						
Duties on merchandise withdrawn from warehouse	723,554.62							
Duties on merchandise exported	968,054.46							
Refundable export duties not claimed within legal period	127,416.78							
Wharfage on merchandise exported	274,823.88							
Duties on merchandise sold at auction	1,993.72							
Surplus on unclaimed merchandise sold at auction, not claimed within legal period	2,755.19							
Tonnage	79,713.52							
Storage, labor, and drayage	15,130.15							
Fines, penalties, and forfeitures	9,356.22							
Licenses issued under section 135, act No. 355	85,736.73							
Sales of customs stamps	46,658.00							
Sales of rolls	168.00							
Sales of blank forms	1,118.73							
Immigration tax	35,788.00							
Chinese registration	137.00							
Miscellaneous fees	54,462.93							
Salaries of officers discharging vessels out of port	224.33							
Total carried to consolidation of all ports	11,755,488.66							
Salaries and wages				651,204.65	1,472.12	649,732.53		
Contingent expenses				108,640.34	24.18	108,616.16		
Salaries of private bonded warehousemen				5,502.18	4,422.21	1.079.97		
Extra services				23,236.27	23,581.11	[a]344.84		
Total				788,583.44	29,499.62	759,083.82		
Port of Iloilo—								
Duties on merchandise imported for immediate consumption	857,818.34							
Duties on merchandise withdrawn from warehouse	48,323.86							
Duties on merchandise exported	95,280.02							
Wharfage on merchandise exported	145,702.22							
Tonnage	2,902.92							
Storage, labor, and drayage	274.12							

DEPARTMENT OF FINANCE AND JUSTICE—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Bureau of Customs—Continued.								
Port of Iloilo—Continued.								
Fines, penalties, and forfeitures	₱535.68							
Licenses issued under sec. 135, act No. 355	7,155.82							
Sales of customs stamps	6,825.80							
Sales of rolls	27.00							
Sales of blank forms	551.13							
Immigration tax	1,088.00							
Miscellaneous fees	1,993.80							
Total carried to consolidation of all ports	1,168,478.71							
Salaries and wages				₱59,211.77	₱203.99	₱59,007.78		
Contingent expenses				1,082.60	62.27	1,020.33		
Extra services				3,218.45	1,869.30	1,349.15		
Total				63,512.82	2,135.56	61,377.26		
Port of Cebu—								
Duties on merchandise imported for immediate consumption	868,043.19							
Duties on merchandise exported	167,087.92							
Wharfage on merchandise exported	51,347.68							
Duties on unclaimed merchandise sold at auction	4.99							
Tonnage	13,998.91							
Storage, labor, and drayage	108.76							
Fines, penalties, and forfeitures	303.40							
Licenses issued under sec. 135, act No. 355	5,998.24							
Sales of customs stamps	4,835.82							
Sales of rolls	45.00							
Sales of blank forms	252.54							
Immigration tax	672.00							
Miscellaneous fees	870.75							
Total carried to consolidation of all ports	1,113,569.20							
Salaries and wages				47,618.53	898.00	46,720.53		
Contingent expenses				6,386.77	103.57	6,283.20		
Extra services				2,240.15	1,357.20	882.95		
Total				56,245.45	2,358.77	53,886.68		

Minor ports—								
Duties on merchandise imported for immediate consumption	7,364.10							
Wharfage on merchandise exported	313.04							
Tonnage	45.83							
Fines, penalties, and forfeitures	50.00							
Licenses issued under sec. 135, act No. 355	558.25							
Sales of customs stamps	9,312.91							
Sale of rolls	58.00							
Sale of blank forms	432.37							
Immigration tax	80.00							
Miscellaneous fees	428.85							
Total carried to consolidation of all ports	18,643.35							
Salaries and wages				48,913.85	4.20	48,909.65		
Contingent expenses				8,912.68	263.11	8,649.57		
Extra service				77.60	13.76	63.84		
Total				57,904.13	281.07	57,623.06		
Duties collected in the United States	834,952.40							
Miscellaneous revenues arising in the customs service—								
Rent of insular government buildings	2,016.00							
Sale of public property	510.15							
	2,526.15		2,526.15					
Operations of the customs arrastre plants—								
Manila—								
Receipts					112,746.45	*a* 19,401.98		
Expenditures				93,344.47				
Jolo—								
Receipts					2,606.07	*a* 931.05		
Expenditures				1,675.02				
Aggregate gain of the arrastre service							*a* 20,333.03	
Consolidated abstract of all ports—								
Duties on merchandise imported for immediate consumption	11,061,622.03							
Duties on merchandise withdrawn from warehouse	771,878.48							
Duties on merchandise exported	1,230,422.40							
Refundable export duties not claimed within legal period	127,416.78							
Wharfage on merchandise exported	472,186.82							
Duties on unclaimed merchandise sold at auction	1,998.71							

a Excess of refunds over expenditures.

DEPARTMENT OF FINANCES AND JUSTICE—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Bureau of Customs—Continued.								
Consolidated extract of all ports—Continued.								
Surplus on unclaimed merchandise sold at auction not claimed within legal period	₱2,755.19							
Tonnage	96,661.18							
Storage, labor, and drayage	15,513.03							
Fines, penalties, and forfeitures	10,245.30							
Licenses issued under section 135, act No. 355	99,449.04							
Sales of customs stamps	67,632.53							
Sales of rolls	298.00							
Sales of blank forms	2,354.77							
Immigration tax	37,628.00							
Chinese registration	137.00							
Miscellaneous fees	57,756.33							
Duties collected in the United States	834,952.40							
Salaries of officers discharging vessels out of port	224.33							
Refunds of customs revenues due to erroneous classification and refunds on coal		₱51,478.46						
Total	14,891,132.32	51,478.46	₱14,839,653.86				₱13,930,542.22	
Consolidated abstract of customs expenditures, including Moro Province—								
Salaries and wages				₱850,155.90	₱2,578.31	₱847,577.59		
Contingent expenses				131,572.65	453.13	131,119.52		
Arrastre plants				95,669.14	115,352.52	*a* 19,683.38		
Salaries private bonded warehousemen				5,502.18	4,422.21	1,079.97		
Extra services				28,997.07	26,821.37	2,175.70		
Total				1,111,896.94	149,627.54	962,269.40		
Customs collections in the Moro Province (deposited in the Moro treasury.)—								
Duties on merchandise imported for immediate consumption	295,797.89							
Duties on merchandise exported	5,122.56							
Wharfage on merchandise exported	5,212.56							
Tonnage	4,479.12							
Storage, labor, and drayage	260.43							
Fines, penalties, and forfeitures	608.40							

Miscellaneous fees, licenses, stamps, sales of rolls, blank forms, immigration tax, extra services, and arrastre plant subsequent to January 1, 1906	9,162.40							
Total	320,643.36							
Total for department of finance and justice			20,212,278.205			2,623,114.12	17,589,164.085	

Refundable export duties were collected during the fiscal year amounting to ₱868,428.02 and refunds made amounting to ₱965,988.28 during the same period. This latter sum includes ₱127,416.78 unclaimed and transferred to customs revenues. There was also deposited during the fiscal year the sum of ₱326.86 on account of surplus on auction sales of unclaimed merchandise, and there was refunded on this account during the same period ₱4,129.29, including ₱2,555.19 unclaimed and covered into customs revenues. For statement of these accounts see "Other resources and liabilities."

DEPARTMENT OF THE INTERIOR.

Bureau of health:								
Veterinary fees	₱4,543.20							
Rental of buildings at Baguio	1,401.63							
Registration fees, medical examinations	1,170.00							
Examination and registration of pharmacists	1,192.00							
Registration of dentists	40.00							
Sales of property	2,478.25							
Total	10,825.08		₱10,825.08					
Salaries and wages				₱364,182.86	₱455.85	₱363,727.01		
Contingent expenses				380,299.22	7.11	380,292.11		
Culion leper colony				31,026.84	256.25	30,770.59		
Total			10,825.08	775,508.92	719.21	774,789.71		₱763,964.63
Bureau of quarantine service:								
Sale of property	79.40		79.40					
Salaries and wages				62,983.33		62,983.33		
Contingent expenses				41,926.34	1,359.34	40,567.00		
Total			79.40	104,909.67	1,359.34	103,550.33		103,470.93
Philippine weather bureau:								
Sales of documents	108.00		108.00					
Salaries and wages				68,399.14		68,399.14		
Contingent expenses				23,210.83		23,210.83		
Total			108.00	91,609.97		91,609.97		91,501.97

a Excess of refunds over expenditures.

DEPARTMENT OF THE INTERIOR—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Mining bureau (consolidated with bureau of science as of Nov. 1, 1905):								
Salaries and wages				₱9,852.31	₱404.44	₱9,447.87		
Contingent expenses				1,585.66		1,585.66		
Total				11,437.97	404.44	11,033.53		₱11.033.53
Forestry bureau:								
Sales of plants and manufactured articles	₱1,105 42		₱1,105.42					
Salaries and wages				120,179.82		120,179.82		
Contingent expenses				34,426.49	18.93	34,407.56		
Total			1,105.42	154,606.31	18.93	154,587.38		153,481.96
Bureau of science:								
Service and sale of property			46,199.095					
Salaries and wages				182,633.99	22.30	182,611.69		
Contingent expenses				85,550.42	4.76	85,545.66		
Purchase of books for library					2,960.80	a 2,960.80		
Total	46,199.095		46,199.095	268,184.41	2,987.86	265,196.55		218,997.455
Bureau of public lands:								
San Lazaro estate	50,243.75							
Certified titles	83.60							
Subsistence furnished	135.00							
Certified copies of documents	5,497.44							
Total	55,959.79		55,959.79					
Salaries and wages				183,643.07	2.05	183,641.02		
Contingent expenses				68,237.11	442.18	67,794.93		
Total			55,959.79	251,880.18	444.23	251,435.95		195,476.16
Bureau of agriculture:								
Sale of farm products	21,489.24							
Veterinary inspections	7,334.03							
Total	28,823.27		28,823.27					

Salaries and wages				178,961.85		178,961.85		
Contingent expenses				90,401.67	12.35	90,389.32		
Total			28,823.27	269,363 52	12.35	269,351.17		240,527.90
Philippines civil hospital (consolidated with bureau of health as of Nov. 1, 1905):								
Subsistence and treatment of patients and sale of medical supplies	32,075.78		32,075.78					
Salaries and wages				24,023.41		24,023.41		
Contingent expenses				52,204.34	70.32	52,134.02		
Total			32,075.78	76,227.75	70.32	76,157.43		44,081.65
Civil sanitarium, Baguio (consolidated with bureau of health as of Nov. 1. 1905):								
Subsistence and treatment of patients, etc	19,975.32		19,975.32					
Salaries and wages				6,324.04	2.32	6,321.72		
Contingent expenses				9,910.84	84.14	9,826.70		
Total			19,975.32	16,234.88	86.46	16,148.42		a 3,826.90
Total for department of the interior			195,151.155			2,013,860.44		1,818,709.285

DEPARTMENT OF COMMERCE AND POLICE.

Bureau of posts:								
Miscellaneous revenues—								
Sale of property	₱5.00		₱5.00					
Expenditures for bureau administration and service at large—								
Salaries and wages				₱76,521.01	₱1,691.02	₱74,829.99		
Mail transportation				129,419.79	81.66	129,338.13		
Contingent expenses				37,264.96	4.68	37,260.28		
Telegraph and telephone service				63,626.66		63,626.66		
Total			5.00	306,832.42	1,777.36	305,055.06		₱305,050.06
The post-office service:								
Postal revenues—								
Postal receipts of the various post-offices in the islands as per offices—								
Stamp stock sold	425,261.50							
Postage on second-class matter	6,293.32							
Miscellaneous receipts	232.25							
Box rent	16,651.52							
Total	448,438.59							

a Excess of refunds over expenditures.

DEPARTMENT OF COMMERCE AND POLICE—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
The post-office service—Continued.								
Postal revenues—Continued.								
Money-order fees, service at large, transferred to postal receipts	₱35,790.18							
Total	484,228.77		₱484,228.77					
Expenditures—								
Expenses of the various post-offices, as per offices—								
Salaries of postmasters				₱168,286.08				
Salaries of clerks				275,587.21				
Contingent expenses				20,562.15				
Total			484,228.77	464,435.44		₱464,435.44		a₱19,793.33
Post-offices—								
Abucay	41.11			120.00				
Abulug	99.86			120.00				
Abuyog	4.62			38.66				
Agno	86.30			119.33				
Agoo	351.80			330.00				
Alaminos	314.89			447.47				
Albay	86.22			88.67				
Alcala, Cagayan	256.66			495.00				
Alcala, Pangasinan	85.58			135.00				
Alfonso	38.03			120.00				
Aliaga	136.74			120.00				
Alilem	66.16			180.00				
Allen	191.12			422.00				
Aloguinsan	35.48			120.00				
Amulung	27.36			120.00				
Anda	58.40			120.00				
Angat	85.12			120.00				
Angeles	829.58			1,569.50				
Antequera	12.16			60.00				
Apalit	140.79			120.00				
Aparri	3,424.47			3,559.15				
Arayat	225.86			180.00				
Argao	267.52			120.00				
Aringay	70.00			120.00				
Aroroy	88.23			150.00				

Asingan	108.46			120.00				
Atimonan	1,070.68			420.00				
Ayuquitan	21.28			120.00				
Bacacay	45.28			120.00				
Bacarra	41.64			120.00				
Bacnotan	50.00			120.00				
Bacolod	4,257.00			4,181.10				
Bacolor	346.90			360.00				
Bacon, Negros Oriental	27.07			120.00				
Bacon, Soregon	21.01			120.00				
Bacoor	244.39			645.99				
Badoc	133.21			330.00				
Bagabag	21.19			120.00				
Baganga	36.40			180.00				
Bago	276.76			390.00				
Baguio	2,919.04			2,622.08				
Bais	532.16			385.67				
Balamban	112.66			120.00				
Balanga	749.98			750.00				
Balangiga	27.04			120.00				
Balaoan	57.01			120.00				
Balasan	21.14			51.00				
Balayan	211.50			180.00				
Baler	19.51			120.00				
Balingasag	4.84			34.67				
Baliuag	483.41			540.00				
Bamban	64.26			180.00				
Bambang	28.08			120.00				
Banate	16.66			56.66				
Bangar	65.79			120.00				
Bangued	450.66			500.00				
Bangui	74.62			390.00				
Bani	50.26			120.00				
Bantayan	49.42			120.00				
Barcelona	43.45			120.00				
Barili	48.48			240.00				
Barugo	123.02			120.00				
Basey	81.51			120.00				
Batac	269.30			360.00				
Batangas	4,222.21			2,760.00				
Bauan	78.92			120.00				
Bauang	57.66			120.00				
Bautista	1,241.04			828.60				
Bay	90.81			420.00				
Bayambang	1,138.50			742.00				
Baybay	613.72			480.00				
Bayombong	827.20			3,953.58				
Binalbagan	195.28			195.00				
Binalonan	219.87			220.00				
Binan	401.86			270.00				
Binangonan	73.56			120.00				

a Excess of refunds over expenditures.

DEPARTMENT OF COMMERCE AND POLICE—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
The post-office service—Continued.								
Post-offices—Continued.								
Binmaley	₱57.42			₱120.00				
Boac	745.17			600.00				
Bocaue	251.30			119.99				
Bogo	65.00			180.00				
Bolinao	237.05			330.00				
Bongabon	64.06			390.00				
Bongao	42.48			239.99				
Bontoc	297.52			300.00				
Borongan	560.02			420.00				
Botolan	19.24			120.00				
Bugason	30.00			60.00				
Buhi	35.37			90.00				
Bulacan	197.69			240.00				
Bulan	171.54			120.00				
Bulusan	39.50			120.00				
Busuanga	3.33			26.33				
Butuan	100.08			240.00				
Cabagan Nuevo	320.44			445.00				
Cabanatuan	393.49			598.70				
Cabugao	118.53			270.00				
Cabuyao	55.39			180.00				
Cadiz	161.23			120.00				
Cagayan	1,606.16			1,422.00				
Calabanga	21.86			120.00				
Calaca	31.18			120.00				
Calamba	792.83			2,192.81				
Calapan	866.26			510.00				
Calape	17.52			120.00				
Calasiao	206.08			240.00				
Calauag	206.83			120.00				
Calauan	50.93			120.00				
Calbayog	3,793.26			4,797.00				
Calivo	129.82			190.00				
Caloocan	108.75			300.00				
Calumpit	514.18			465.00				
Camalaniugan	46.96			120.00				
Camalig	114.03			120.00				
Camiling	176.25			240.00				
Camp Jossman	1,348.38			900.00				
Camp Keithley	3,551.64			2,800.00				

Camp Overton	2,435.39			2,320.00				
Camp Stotsenburg	4,254.07			1,600.00				
Candaba	111.45			300.00				
Candon	786.15			602.30				
Capalonga	73.71			120.00				
Capas	147.70			180.00				
Capiz	2,037.68			1,192.00				
Caramoan	23.23			84.00				
Carcar	116.12			240.00				
Carigara	1,057.85			250.00				
Carmen, Bohol	27.04			53.67				
Carmen, Cebu	15.64			120.00				
Carranglan	63.00			270.00				
Casiguran	123.47			150.00				
Cataingan	49.78			120.00				
Catanauan	30.52			120.00				
Catarman	595.58			984.00				
Catbalogan	4,152.30			900.00				
Catmon	35.70			120.00				
Catubig	49.32			54.00				
Cauayan, Isabela	506.62			390.00				
Cauayan, Negros Occidental	21.46			120.00				
Cavite	8,822.02			5,930.00				
Cebu	14,144.00			7,356.14				
Cervantes	869.05			1,018.90				
Concepcion	132.90			120.00				
Coron	58.62			120.00				
Corregidor	223.31			260.66				
Cotabato	2,499.18			1,989.33				
Cuenca	15.10			120.00				
Culasi	29.77			43.33				
Culion	30.50			120.00				
Currimao	283.92			324.00				
Cuyapo	206.07			180.00				
Cuyo	264.84			510.00				
Daan-Bantayan	20.00			120.00				
Daet	622.69			1,364.00				
Dagami	34.48			39.67				
Dagupan	4,081.36			8,305.04				
Dalaguete	45.03			120.00				
Danao	69.12			120.00				
Dao, Antique	13.02			46.33				
Dao, Capiz	24.44			42.00				
Dapitan	132.06			180.00				
Daraga	216.51			180.00				
Dauin	23.88			120.00				
Dauis	30.14			180.00				
Davao	776.34			918.89				
Dinalupijan	72.07			420.00				
Dingras	79.47			120.00				
Donsol	73.90			120.00				
Dulag	7.28			39.33				

DEPARTMENT OF COMMERCE AND POLICE—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
The post-office service—Continued.								
Post-offices—Continued.								
Dumaguete	₱2,602.04			₱1,290.00				
Dumanjug	148.56			120.00				
Dumarao	3.42			20.00				
Dupax	30.74			255.00				
Echague	460.94			420.00				
Enrile	6.92			103.33				
Escalante	278.26			270.00				
Floridablanca	40.72			120.00				
Fort William McKinley	1,061.86			1,173.13				
Gamu	28.70			120.00				
Gandara	372.66			945.00				
Gapan	102.74			120.00				
Gattaran	23.44			120.00				
Ginatilan	35.83			120.00				
Goa	50.34			82.33				
Guagua	157.75			120.00				
Gubat	146.40			120.00				
Guiljugan	244.60			681.33				
Guimbal	14.00			64.00				
Guinayangan	361.46			180.00				
Guindulman	41.40			63.00				
Guinobatan	641.30			512.00				
Hagonoy	103.68			120.00				
Hiloñgos	250.00			330.00				
Iba	906.92			2,320.00				
Ibaan	24.02			120.00				
Ibajay	9.00			27.00				
Iguig	45.98			120.00				
Ilagan	2,329.43			2,170.47				
Iligan	1,920.45			600.00				
Ilog	106.94			115.98				
Iloilo	16,512.30			8,280.85				
Imus	587.83			300.00				
Inabanga	30.00			60.00				
Indan	71.15			120.00				
Indang	113.53			840.00				
Infanta, Pangasinan	33.12			120.00				
Infanta, Tayabas	104.46			120.00				
Initao	8.36			26.66				
Iriga	511.56			390.00				

Irosin	64.40			120.00				
Isabela	132.22			120.00				
Jagna	39.70			120.00				
Jamindan	5.00			19.00				
Janiuay	7.62			57.66				
Jaro	98.00			106.67				
Jimamailan	65.36			120.00				
Jimenez	33.00			45.00				
Jinigaran	141.08			120.00				
Jolo	3,057.34			2,240.00				
Jovellar	19.28			120.00				
Juban	69.68			120.00				
Labo	44.56			120.00				
La Carlota	652.91			466.99				
La Castellana				35.00				
Lallo	500.52			330.00				
Lañgaran	2,525.00			1,718.43				
Laoag	11.70			30.00				
Laoang	898.49			1,290.00				
Lapo	20.58			120.00				
Larena	28.17			120.00				
Lazi	13.10			47.67				
Legaspi	7,926.89			6,628.64				
Leon	13.00			63.33				
Libacao	2.10			28.33				
Libmanan	55.27			290.00				
Libog	123.01			120.00				
Licab	87.11			120.00				
Ligao	819.00			660.00				
Liloan	101.80			120.00				
Lingayen	2,377.28			1,017.33				
Lipa	281.98			1,140.00				
Loay	27.38			180.00				
Loboc	21.40			180.00				
Loboo	13.50			120.00				
Lopez	210.46			120.00				
Los Baños	1,000.75			1,092.00				
Lubao	81.41			120.00				
Lucban	225.73			220.00				
Lucena	6,044.86			6,635.73				
Lupi	34.73			120.00				
Luzuriaga	17.24			120.00				
Maasin	700.40			1,140.00				
Mabalacat	86.63			156.00				
Macabebe	117.29			240.00				
Magalan	53.54			120.00				
Magallanes	28.10			120.00				
Magarao	15.66			120.00				
Magdalena	60.00			180.00				
Magsingal	48.06			120.00				
Majayjay	59.40			180.00				
Malabang	3,221.15			2,800.00				

DEPARTMENT OF COMMERCE AND POLICE—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
The post-office service—Continued.								
Post-offices—Continued.								
Malabon	₱138.40			₱180.00				
Malabuyoc	47.30			120.00				
Malahi Island	273.68							
Malasiqui	150.52			120.00				
Malolos	3,018.98			1,305.10				
Mambajao	288.31			360.00				
Mambulao	45.20			120.00				
Mambusao	5.00			19.67				
Manaoag	124.00			180.00				
Manapla	94.90			120.00				
Mandaon	16.74			120.00				
Mandaue	52.34			120.00				
Mangaldan	117.69			185.00				
Mangatarem	65.02			135.00				
Manila	244,358.27			229,329.61				
Manito	19.00			120.00				
Maragondon	58.28			120.00				
Maribojoc	42.98			120.00				
Mariquina	75.73			240.00				
Mariveles	383.12			315.00				
Masbate	1,002.65			818.79				
Masinloc	107.20			294.00				
Mati	32.20			120.00				
Mauban	194.02			135.00				
Mercedes	53.72			184.00				
Mexico	175.28			180.00				
Meycauayan	126.32			135.00				
Miagao	70.02			273.66				
Milagros	90.01			120.00				
Minglanilla	20.02			120.00				
Misamis	410.64			240.00				
Moalbual	59.46			120.00				
Moncada	311.07			240.00				
Morong	39.16			120.00				
Mulanay	30.30			180.00				
Murcia	26.10			120.00				
Nabua	94.14			90.00				
Naga	60.68			120.00				
Nagcarlan	52.32			120.00				
Naguilian, Isabela	31.30			120.00				

Naguilian, Union	163.19			280.00				
Naic	325.42			270.00				
Namacpacan	311.40			346.00				
Narvacan	194.84			390.00				
Nasugbu	153.54			120.00				
New Washington	29.74			190.00				
Noveleta	79.60			180.00				
Nueva Caceres	4,057.09			2,784.47				
Olongapo	2,660.93			2,623.99				
Orani	190.80			120.00				
Oras	409.18			210.00				
Orion	94.51			145.00				
Ormoc	2,046.26			1,800.00				
Oroquieta	268.93			300.00				
Oslob	74.72			120.00				
Oton	11.96			65.00				
Paete	90.00			240.00				
Pagbilao	112.38			135.00				
Pagsanjan	575.13			360.00				
Palo	136.92			120.00				
Pandan, Albay	29.27			120.00				
Pandan, Antique	18.70			42.00				
Pañgil	45.00			120.00				
Paniqui	241.49			240.00				
Paoay	65.10			120.00				
Paombong	65.48			120.00				
Paracale	72.54			120.00				
Parang-Parang	1,485.05			964.99				
Parañaque	18.09			150.00				
Pasacao	212.16			915.00				
Pasay	46.54			120.00				
Pasig	972.28			1,257.32				
Passi	43.52			55.33				
Pasuquin	80.21			120.00				
Peñaranda	80.18			120.00				
Piat	35.00			120.00				
Piddig	25.04			120.00				
Pila	54.10			71.00				
Pilar, Capiz	9.16			32.66				
Pilar, Sorsogon	120.04			180.00				
Pinamuñgajan	32.94			120.00				
Pitogo	90.78			135.00				
Polañgui	145.72			195.00				
Polo	243.76			209.17				
Pontevedra, Capiz	12.80			33.33				
Pontevedra, Negros Occidental	266.57			421.00				
Porac	54.60			180.00				
Pototan	31.64			142.00				
Pozorrubio	125.11			360.00				
Puerto Princesa	454.43			530.00				
Pulanduta	64.76			120.00				
Pura	200.46			210.00				

DEPARTMENT OF COMMERCE AND POLICE—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
The post-office service—Continued.								
Post-offices—Continued.								
Quiñgua	₱174.11			₱180.00				
Ragay	35.82			120.00				
Romblon	1,008.56			600.00				
Rosales	100.00			120.00				
Rosario	32.98			120.00				
Sagada	170.47			96.00				
Sagay	67.23			120.00				
Sagnay	27.20			73.33				
Salasa	45.86			120.00				
Salomague	63.10			240.00				
San Antonio	48.46			120.00				
San Carlos, Negros Occidental	431.01			413.50				
San Carlos, Pangasinan	196.20			175.00				
Sanchez Mira	45.32			120.00				
San Esteban	30.93			420.00				
San Fabian	91.10			120.00				
San Felipe Neri	32.64			120.00				
San Fernando, Cebu	36.00			120.00				
San Fernando, Sorsogon	26.32			120.00				
San Fernando, Pampanga	2,102.96			2,619.30				
San Fernando, Union	3,564.87			3,025.00				
San Francisco	172.78			270.00				
San Isidro, Nueva Ecija	1,682.18			2,787.98				
San Isidro, Pangasinan	36.98			120.00				
San Jacinto	37.30			210.00				
San José, Antique	978.87			1,329.72				
San José, Batangas	13.94			120.00				
San José, Camarines	124.37			180.00				
San José, Nueva Ecija	135.35			120.00				
San Juan, Union	40.95			120.00				
San Juan de Bocboc	56.98			120.00				
San Juan de Guimba	57.20			120.00				
San Luis	72.92			180.00				
San Marcelino	74.27			180.00				
San Mateo	234,58			638.00				
San Miguel	47.06			120.00				
San Miguel de Mayumo	223.90			195.00				
San Narciso	63.05			180.00				
San Nicolas	43.14			120.00				
San Pablo	371.90			240.00				

San Pedro Macati	22.45			120.00				
San Pedro Tunasan	47.22			180.00				
San Quintin	48.06			120.00				
San Remigio	16.64			120.00				
Santa	18.02			120.00				
Santa Barbara	10.60			58.33				
Santa Cruz, Cavite	63.84			180.00				
Santa Cruz, Ilocos Sur	44.10			120.00				
Santa Cruz, Laguna	2,560.77			1,460.00				
Santa Cruz, Tayabas	117.55			150.00				
Santa Cruz, Zambales	138.92			375.33				
Santa Lucia	40.02			120.00				
Santa Maria, Bulacan	95.18			119.99				
Santa Maria, Ilocos Sur	117.29			120.00				
Santa Rita	22.76			120.00				
Santa Rosa	128.74			120.00				
Santo Tomas, Batangas	238.49			420.00				
Santo Tomas, Pampanga	34.20			120.00				
Santo Tomas, Union	34.00			120.00				
San Vicente	24.80			120.00				
Sapian	3.82			31.33				
Sara	46.80			78.50				
Saravia	77.74			120.00				
Sariaya	169.14			150.00				
Siasi	146.58			240.00				
Siaton	16.44			69.00				
Sibalom	20.12			48.00				
Sibonga	47.56			120.00				
Silang	111.42			120.00				
Silay	465.20			415.00				
Sinait	30.92			120.00				
Siniloan	51.94			120.00				
Sipocot	35.52			120.00				
Siquijor	42.66			120.00				
Solana	14.76			120.00				
Solano	29.74			120.00				
Sorsogon	2,965.15			2,963.14				
Sual	63.90			120.00				
Subic	291.49			422.97				
Surigao	1,502.68			1,490.00				
Taal	146.21			180.00				
Tabaco	1,861.57			1,523.88				
Tabogon	30.74			120.00				
Tacloban	6,294.26			5,398.15				
Taft	163.90			240.00				
Tagbilaran	1,313.05			1,630.00				
Tagoloan	2.00			35.67				
Tagudin	160.36			270.00				
Taguig	67.00			120.00				
Talavera	41.67			120.00				
Talibon	29.88			60.00				
Talisay, Cebu	25.80			114.00				

DEPARTMENT OF COMMERCE AND POLICE—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
The post-office service—Continued.								
Post-offices—Continued.								
Talisay, Negros Occidental	₱91.66			₱120.00				
Talisayan	8.22			33.66				
Tanauan, Batangas	156.93			180.00				
Tanauan, Leyte	22.76			75.00				
Tanay	172.32			180.00				
Tanjay	37.50			120.00				
Tapas	11.78			20.66				
Tarlac	1,291.72			780.50				
Tayabas	326.64			180.00				
Tayasan	158.00			221.00				
Tayug	404.97			407.33				
Tiaong	48.62			120.00				
Tibiao	28.33			43.33				
Tigaon	50.66			120.00				
Tigbauan	16.50			96.50				
Toledo	147.03			150.00				
Tolong	26.98			120.00				
Tuao	12.46			120.00				
Tubao	37.88			120.00				
Tubigon	41.99			180.00				
Tuburan	71.64			120.00				
Tuguegarao	2,984.54			3,534.96				
Tumauini	162.89			390.00				
Twin peaks	230.05			459.67				
Umingan	55.06			180.00				
Urdaneta	109.88			180.00				
Uson	28.40			120.00				
Valencia	47.82			120.00				
Valladolid	265.38			350.00				
Victoria	128.67			150.00				
Victorias	57.98			120.00				
Vigan	4,696.28			4,966.98				
Villa Real	2.62			120.00				
Villasis	73.56			120.00				
Virac	706.94			510.00				
Zamboanga	8,471.42			5,543.04				
Total	484,228.77			464,435.44				

Signal service:								
Telegraph and telephone tolls	61,345.97							
Sales of property	80.00							
Total	61,425.97		61,425.97					
Salaries and wages				67,221.335	39.96	67,181.375		
Contingent expenses				56,629.60	33.26	56,596.34		
Total			61,425.97	123,850.935	73.22	123,777.715		62,351.745
Bureau of coast and geodetic survey:								
Sales of property	91.00		91.00					
Salaries and wages				91,393.40		91,393.40		
Contingent expenses				71,519.27		71,519.27		
Total			91.00	162,912.67		162,912.67		162,821.67
Bureau of public works:								
Sales of property	44.88		44.88					
Salaries and wages				198,305.01	572.32	197,732.69		
Contingent expenses				37,761.81	.62	37,761.19		
Public works				92,460.61		92,460.61		
Purchase of supplies				51,495.32	1,782.45	49,712.87		
Maintenance, alteration, and repair of public buildings				57,498.73	4,749.92	52,748.81		
Public works transferred from bureau of architecture				1,891.76	3,010.18	*a* 1,118.42		
Maintenance and repair of the Benguet road				90,051.39		90,051.39		
Total			44.88	529,464.63	10,115,49	519,349.14		519,304.26
Bureau of constabulary:								
Rent of launches	240.00							
Transportation furnished	106.07							
Sales of property	46.15							
Total	392.22		392.22					
Pay of constabulary				2,032,770.78	4,320.42	2,028,450.36		
Subsistence				443,597.47	1,537.55	442,059.92		
Transportation				486,800.08	11,236.43	475,563.65		
Clothing, camp, and garrison equipage				509,049.33	26,349.44	482,699.89		
Contingent expenses				77,658.26	128.62	77,529.64		
Barracks and quarters				178,304.73	529.75	177,774.98		
Telegraph and telephone service				57,253.68	106.91	57,146.77		
Secret service				43,546.21	124.01	43,422.20		
Land transportation sale to city of Manila					5,745.70	*a* 5,745.70		
Total			392.22	3,828,980.54	50,078.83	3,778,901.71		3,778,509.49

DEPARTMENT OF COMMERCE AND POLICE—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Operations of the constabulary commissary:								
Sales of supplies					₱491,800.58			
Purchase of supplies				₱267,307.68		*a* ₱224,492.90		*a* ₱224,492.90
Bureau of navigation:								
Transportation of passengers and freight	₱193,256.13							
Sale of property	2.19							
Total	193,258.32		₱193,258.32					
Salaries and wages				110,930.95		110,930.95		
Contingent expenses				13,829.09		13,829.09		
Light-house service, permanent improvements				651.70		651.70		
Light-house service				381,031.59	72.50	380,959.09		
Marine railway and repair shop				67,343.31	69,804.05	*a* 2,460.74		
Cutters and launches				993,967.96	40,391.47	953,576.49		
Total			193,258.32	1,567,754.60	110,268.02	1,457,486.58		1,264,228.26
Bureau of port works:								
Sale of property	164.30		164.30				₱164.30	
Oriente Building:								
Salaries and wages				1,550.00		1,550.00		
Contingent expenses				7,645.53	1,069.44	6,576.09		
Total				9,195.53	1,069.44	8,126.09		8,126.09
Bureau of architecture (consolidated with bureau of public works as of November 1, 1905):								
Salaries and wages				17,705.32		17,705.32		
Contingent expenses				8,260.84	621.54	7,639.30		
Building supplies				38,852.35	40,542.41	*a* 1,690.06		
Land transportation sale to city of Manila					106,444.70	*a* 106,444.70		
Public works				64,151.91	17,127.70	47,024.21		
Permanent improvements				619.86	619.86			
Total				129,590.28	165,356.21	*a* 35,765.93		*a* 35,765.93

Santa Potenciana:								
Salaries and wages				116.00		116.00		
Contingent expenses				1,181.31		1,181.31		
Total				1,297.31		1,297.31		1,297.31
Intendencia Building:								
Salaries and wages				263.89		263.89		
Contingent expenses				2,234.82		2,234.82		
Total				2,498.71		2,498.71		2,498.71
Fortin Building:								
Contingent expenses				4,177.41		4,177.41		4,177.41
Total for department of commerce and police			739,610.46			6,567,759.005		5,828,148.545

DEPARTMENT OF PUBLIC INSTRUCTION.

Bureau of supply:								
Rental of buildings	148.50		148.50					
Salaries and wages				267,657.00	16.05	267,640.95		
Contingent expenses				92,322.22	54.45	92,267.77		
Construction of lorchas, act No. 831				1,750.00		1,750.00		
Land transportation sale to city of Manila					89,256.68	a 89,256.68		
Total			148.50	361,729.22	89,327.18	272,402.04		272,253.54
Operations of the insular purchasing agent on account of purchase of supplies:								
Sales of supplies					4.028,486.52			
Purchase of supplies				3,644,262.32		a 384,224.20		a 384,224.20
Bureau of cold storage:								
Sales of ice, distilled water, rent of cold storage, and miscellaneous	713,442.10		713,442.10					
Salaries and wages				148,836.68		148,836.68		
Contingent expenses				123,779.92	652.59	123,127.33		
Land transportation sale to city of Manila					3,095.77	a 3,095.77		
Total			713,442.10	272,616.60	3,748.36	268,868.24		a 444,573.86
Bureau of prisons:								
Sales of articles manufactured, and from laundry department	108,006.95							
Maintenance of prisons	158,431.70							
Damage to roof of building	10.00							
Total	266,448.65		266,448.65					

[a] Excess of refunds over expenditures.

DEPARTMENT OF PUBLIC INSTRUCTION—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Bureau of prisons—Continued.								
Salaries and wages				₱163,808.29	₱1.00	₱163,807.29		
Contingent expenses				578,046.72	36.00	578,010.72		
Manufacturing supplies				197,323.08		197,323.08		
Installation of electric light and power				4,270.09		4,270.09		
Salaries and wages, manufacturing department				54,544.73		54,544.73		
Manufacture and sale of carabao carts and wheels				355.71	17,346.98	*a* 16,991.27		
Total			₱266,448.65	998,348.62	17,383.98	980,964.64		₱714,515.99
Bureau of education:								
Sales of property	₱540.38		540.38					
Salaries and wages				2,240,469.72	4,323.14	2,236,146.58		
Contingent expenses				744,817.65	1,059.78	743,757.87		
Total			540.38	2,985,287.37	5,382.92	2,979,904.45		2,979,364.17
Bureau of printing:								
Subscription to and purchase of the Journal and Official Gazette	10,762.17							
Sale of public documents	964.35							
Printing and binding executed for cash	256,078.47							
Total	267,804.99		267,804.99					
Salaries and wages				263,708.74	788.88	262,919.86		
Contingent expenses				121,937.78	13.55	121,924.23		
Total			267,804.99	385,646.52	802.43	384,844.09		117,039.10
Ethnological survey (consolidated with bureau of education as of Nov. 1, 1905):								
Salaries and wages				5,916.55				
Contingent expenses				1,709.51				
Total				7,626.06		7,626.06		7,626.06
American circulating library (consolidated with bureau of education as of Nov. 1, 1905):								
Salaries and wages				1,672.47		1,672.47		

Contingent expenses				1,121.40		1,121.40		
Purchase of books				3,160.12	1,766.40	1,393.72		
Total				5,953.99	1,766.40	4,187.59		4,187.59
Total for department of public instruction			1,248,384.62			4,514,572.91		3,266,188.29
UNASSIGNED SERVICE.								
Port of Iloilo				₱33,836.45	₱16.25	₱33,820.20		
Port of Cebu				2,665.58		2,665.58		
Jolo wharf					162.37	[a] 162.37		
Cuyo wharf				664.34		664.34		
Chief engineer, Division of the Philippines:								
Contingent expenses				5.82		5.82		₱5.82
Benguet improvements:								
Construction of Benguet road				26,474.05	133,717.43	[a] 107,243.38		
Sales of commissaries				1,289.12	9,993.48	[a] 8,704.36		
Total				27,763.17	143,710.91	[a] 115,947.74		[a] 115,947.74
Chief quartermaster, Division of the Philippines:								
Expenses, Department of the Visayas, act No. 163				479.20				
Pay of interpreters					1.70			
Contingent expenses					.01			
Claims for damages					585.12			
Total				479.20	586.83	[a] 106.63		[a] 106.63
Insular salary and expense fund: (Under the above caption provision is made in the general appropriation acts for a fund from which is made payable the traveling expenses of officers and employees from the United States to Manila, accrued leave due to officers and employees who die or resign and whose places must be filled at once, and other miscellaneous expenditures properly authorized but not chargeable to the appropriation of a particular bureau. Traveling expenses of officers and employees from the United States to Manilla are payable only after two years of satisfactory service, but the Government will furnish transportation to the islands, to be reimbursed at the rate of 10 per cent per month of the employee's salary, even though the whole amount may be later refundable to the officer or employee. It is from these 10 per cent deductions that the refunds arise)				533,112.13	295,102.45	238,009.68		238,009.68
Philippines exposition board:								
Purposes of Philippines Exhibit at St. Louis Exposition				21,488.75	6,668.76	14,819.99		14,819.99

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[a] Excess of refunds over expenditures.

UNASSIGNED SERVICE—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Philippine census:								
Expenses of taking the census				₱2,888.80		₱2,888.80		₱2,888.80
Collecting librarian:								
Salary and expenses of collecting librarian				1,516.43		1,516.43		1,516.43
Consulting architect:								
Salary and expenses of the consulting architect				7,959.02		7,959.02		7,959.02
Total for unassigned service						186,133.12		186,133.12

REVENUES ARISING FROM OTHER THAN ORDINARY SOURCES THAN INSULAR GOVERNMENT ADMINISTRATION.

	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Miscellaneous:								
Rent of land leased to Philippine Telegraph and Telephone Co	₱1,200.00		₱1,200.00					
Interest on bank deposits	417,637.12		417,637.12					
Settlement warrants canceled (nonpresentation after three years)	7.69		7.69					
Cable concessions	99,379.77		99,379.77					
Railway franchises	5,008.47		5,008.47					
Excess deposits in insular treasury	431.30	₱338.44	92.86					
Total	523,664.35	338.44	523,325.91				₱523,325.91	
Spanish seized funds:								
Amount derived from sale of certain property seized on American occupation and carried as Spanish seized funds	3,836.01		3,836.01				3,836.01	
Arbitrary currency expression:								
Gain in exchange of currency due to arbitrary expression	793.815		793.815				793.815	
Allowances to accountable officers for losses of funds:								
Allowances under section 41 of the accounting act, being amounts recovered previously written off	878.46		878.46				878.46	
Total	529,172.635	338.44	528,834.195				528,834.195	

EXPENDITURES FOR OTHER PURPOSES THAN INSULAR GOVERNMENT ADMINISTRATION.

Insular aid to provincial administrative expenses:								
Province of Palawan, general purposes				₱23,160.00		₱23,160.00		
Province of Palawan, cancellation of loans				20,615.38		20,615.38		
Province of Mindoro, general purposes				41,700.00		41,700.00		
Province of Benguet, general purposes				20,000.00	₱0.85	19,999.15		
Province of Zambales, general purposes				5,000.00		5,000.00		
Province of Lepanto-Bontoc, general purposes				29,250.00		29,250.00		
Province of Nueva Vizcaya, general purposes				17,500.00		17,500.00		
Province of Abra, liquidating outstanding indebtedness on consolidation				14,497.13		14,497.13		
Province of Masbate, cancellation of loans				5,000.00		5,000.00		
Reimbursement to provinces of calendar year 1906, land taxes				1,317,694.30		1,317,694.30		
Additional reimbursement to province of Cebu of calendar year 1906, land taxes				16,160.69		16,160.69		
Construction of school building at Cabanatuan				250.00		250.00		
Refund of insurgent tax funds, province of Cagayan				30,000.00		30,000.00		
Refund of seized funds, province of Surigao				4,111.60		4,111.60		
Assistance to school of Cavite province				13,877.68		13,877.68		
Total				1,558,816.78	.85	1,558,815.93		₱1,558,815.93
Insular contribution to city of Manila:								
Total amount contributed, being 30 per cent of moneys withdrawn for expenditure on city of Manila account, less amount repaid to insular treasury				1,338,385.74		1,338,385.74		1,338,385.74

MISCELLANEOUS.

Expenses of official party accompanying Secretary of War to the Philippine Islands				₱53,709.93		₱53,709.93		
Extra compensation to F. W. Carpenter				1,000.00		1,000.00		
Coal supply fund					₱1,074.59	*a* 1,074.59		
Reimbursement to British-Manila Estates Co				2,195.00		2,195.00		
Interest on friars lands bonds				416,240.00		416,240.00		
Interest on public improvement bonds				198,935.00		198,935.00		
Expenses of Burnham and Anderson				1,127.90		1,127.90		
Roads and bridges, act No. 1				6,358.73	30.41	6,328.32		
Dredging Santa Cruz estero				3,448.13		3,448.13		
Pay of insular police at Cavite				9,711.10		9,711.10		
Subsidies to Sultan of Sulu and his advisers				19,517.50		19,517.50		
Additional compensation to W. Morgan Shuster				1,750.00		1,750.00		
Maps for insular officials				84.46		84.46		
San Jose College litigation expenses				1,000.00		1,000.00		
Miscellaneous, fiscal year 1901				296.84	58.55	238.29		
Sales of rice under act No. 495					2,949.05	*a* 2,949.05		

a Excess of refunds over expenditures.

MISCELLANEOUS—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Extra compensation to C. H. Sleeper				₱1,375.00		₱1,375.00		
Rewards to crew of S. S. Landaura				870.00		870.00		
Refund of provost fees collected at Montalban				1,100.00		1,100.00		
Honorary commission of Filipinos visiting St. Louis				1.00		1.00		
Relief of Elas et al				600.00		600.00		
Reimbursement to municipality of Lumbang				852.80		852.80		
Refund to Sultan of Sulu				482.70		482.70		
Total				720,656.09	₱4,112.60	716,543.49		₱716,543.49
Total for other purposes than insular government administration			₱528,834.195			3,613,745.16		3,084,910.96
Allowances in liquidation and mitigation of claims: Allowances to accountable officers under section 42 of the accounting act				4,405.88	585.12	3,820.76		3,820.76
Total expenditures for other purposes than insular government administration			528,834.195			3,613,745.16		3,084,910.965
Grand total for departments, bureaus, offices, and other purposes			22,936,134.325			20,293,558.245		
Excess of net revenues over net expenditures as per balance sheet and extended to surplus and deficiency account thereon							₱2,642.576.08	

CITY OF MANILA.

FINANCES OF THE CITY OF MANILA UNDER ITS CHARTER.

Under the Manila city charter all revenues collected are deposited with the treasurer of the islands to the credit of the city. Disbursements are made pursuant to the appropriations of the Philippine Commission, but under section 15 of the charter 30 per cent of the appropriations for the city are payable out of the insular treasury and 70 per cent out of the revenues deposited by the city to its credit.

Following is a statement, in Philippines currency, of the revenues collected by, and the expenditures under, the various departments of the government of the city of Manila during the fiscal year 1906, and a showing of the balance due the insular government on June 30, 1906, comprehending the bond issue of ₱2,000,000, for which the insular government is liable, and the loan of ₱350,000 from the public works and permanent improvements fund, for the purpose of the Luneta extension.

The insular government in account with the city of Manila for the various items of revenue and expenditure on account of the city of Manila during the fiscal year 1906.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Municipal board:								
Salaries and wages				₱91,634.70	₱3,900.00			
Contingent expenses				109,847.98	67.78			
Total				201,482.68	3,967.78	₱197,514.90		₱197,514.90
Department of assessments and collections:								
Industrial taxes	₱1,191.81							
Land taxes	1,208,263.44							
Matadero taxes	160,049.25							
Market taxes	269,389.43							
Licenses	217,958.16							
Registration certificates	846.00							
Vehicle equipment	1,231.30							
Rent of public lands	18,710.00							
Electrical installation certificates	7,868.70							
Live stock registration	678.30							
Burial permits	4,935.60							
Poundmaster's fees	4,077.00							
Municipal court fees and fines	68,500.77							
City attorney's fees and fines	187.02							
Sheriff's fees and fines	13,689.36							
Justice of the peace fees and fines	6,757.90							
Sales of real estate	2,644.30							
Water rents	210,733.29							

The insular government in account with the city of Manila for the various items of revenue and expenditure on account of the city of Manila during the fiscal year 1906—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Department of assessments and collections—Cont'd.								
Building applications and permits	₱17,935.32							
Testing weights and measures	6,410.40							
Boiler inspections	1,070.00							
Telephone franchise tax	3,381.24							
Railroad franchise tax	28,662.85							
Live stock registration	107.50							
Registration of land	50.30							
Internal revenue refund	74,876.93							
Miscellaneous fees	3,668.82							
Total	2,333,874.99		₱2,333,874.99					
Salaries and wages				₱75,188.63	₱55,327.11			
Contingent expenses				8,367.34	3,100.00			
Tax refunds				33,839.99				
Total			2,333,874.99	117,395.96	58,427.11	₱58,968.85	₱2,274,906.14	
Department of engineering and public works:								
Salaries and wages				504,798.16	4,660.28			
Contingent expenses				615,972.73	88,392.50			
Reimbursement from sewer and waterworks construction fund, act No. 1422					227,102.86			
Public works and permanent improvements				830,113.56	131,737.80			
Total				1,950,884.45	451,893.44	1,498,991.01		₱1,498,991.01
Department of sanitation and transportation:								
Transportation of meat	3,470.74							
Sale of burial lots	13,415.09							
Rent of niches	10,122.40							
Pail system	59,327.16							
Cleaning vaults and cesspools	38,691.85							
Services rendered and supplies furnished	133,067.04							
Total	258,094.28		258,094.28					

Salaries and wages				553,825.67	248.00			
Contingent expenses				316,131.52	979.41			
Total			258,094.28	869,957.19	1,227.41	868,729.78		610,635.50
Fire department:								
Salaries and wages				238,954.74				
Contingent expenses				79,119.47	153.50			
Total				318,074.21	153.50	317,920.71		317,920.71
Law department:								
Salaries and wages				129,229.22				
Contingent expenses				23,804.90	822.47			
Total				153,034.12	822.47	152,211.65		152,211.65
Police department:								
Salaries and wages				1,100,204.65	1,222.70			
Contingent expenses				67,230.08	12,225.22			
Total				1,167,434.73	13,447.92	1,153,986.81		1,153,986.81
Department of city schools:								
Salaries and wages				255,555.04				
Contingent expenses				17,516.22				
Total				273,071.26		273,071.26		273,071.26
Department of sewer and waterworks construction:								
Salaries and wages				768.01	[a]6,493.77			
General purposes				9,958.63	[a]9,958.63			
Total			5,725.76	10,726.64	16,452.40		5,725.76	
Miscellaneous:								
Penalties collected on account of defective contract work	60.00							
Registration of deeds	14,850.11							
Interest on sewer and waterworks construction fund bank deposits	40,694.92							
Refunds of revenue		1,106.10						
Total	55,605.03	1,106.10	54,498.93					
Luneta extension				260,020.08				
Expenses of Burnham and Anderson				2,255.80				
Mariquina Valley claims, act No. 1252				1,680.00				
Land transportation purchased from insular government				221,365.97	96,859.10			

[a] The above amounts were refunded from the proceeds of bond issue, and represented preliminary expenditures from city funds before bond issue was consummated.

The insular government in account with the city of Manila for the various items of revenue and expenditure on account of the city of Manila during the fiscal year 1906—Continued.

	Revenues.			Expenditures.			Excess of—	
	Gross.	Refund.	Net.	Gross.	Refund.	Net.	Revenues over expenditures.	Expenditures over revenues.
Miscellaneous—Continued.								
City of Manila salary and expense fund				₱15,155.74	₱69.00			
Interest on sewer and waterworks construction bonds				59,840.00				
Total			₱54,498,93	560,317.59	446,928.10	₱463,389.49		408,890.56
Total			2,652,193.96			4,984,784.46	₱2,280,631.90	₱4,613,222.40
Excess of expenditures over revenues carried to summary, exclusive of insular government's contribution								2,332,590.50

SUMMARY.

Balance due insular government July 1, 1905		₱2,406,433.92
Loan for the purpose of Luneta extension here entered as an asset of the insular government		350,000.00
Excess of expenditures over revenues collected and expended by the city government as shown by preceding detailed statements	₱2,332,590.50	
Less contribution by insular government, being 30 per cent on net withdrawals on account of city of Manila during the fiscal year	1,338,385.74	
Net excess of expenditures over all receipts		994,204.76
Total charges		3,750,638.68
Proceeds of loan from insular government here entered as a credit to the city of Manila, per contra entry		350,000.00
Balance due insular government and carried to the balance sheet as an asset		3,400,638.68

CONGRESSIONAL RELIEF FUND.

By act of Congress approved March 3, 1903, the sum of $3,000,000, United States currency was appropriated for relief of distress in the Philippine Islands, to be expended under the direction and in the discretion of the Philippine government in such proportion as they deem wise, in the direct purchase and distribution or sale of farm implements, farm animals and supplies and necessaries of life, and through the employment of labor in the construction of government wagon roads and other public works. The act further provides that the governor of the Philippines shall submit to the Secretary of War a statement of all expenditures under this fund.

The sum so appropriated was transmitted to the treasurer of the Philippine Islands and taken into the account of insular funds as ₱6,000,000. As contemplated by the appropriating act, and for the purpose of making the reports required thereunder, the identity of the fund has been maintained and expenditures made therefrom have been segregated from the ordinary expenses of the government.

The procedure inaugurated by the Philippine Commission as to the disposition of this fund was to set apart by means of appropriation acts specific sums for specified purposes, such as public works, etc., as well as amounts for expenditure under the direction of the governor-general in such manner as might from time to time be authorized by resolution of the Commission.

The following statement of accounts shows the expenditures from the fund, as audited, during the fiscal year 1906. The balance shown as the liability of the insular government represents cash in the insular treasury and balances in the hands of collecting and disbursing officers.

	Gross expenditures.	Refunds to expenditures.	Net expenditures.	Total.
Balance July 1, 1905				₱1,515,737.82
Purchase, care, and sale of carabao	₱23,527.26	₱67,349.58	[a] ₱43,822.32	
Purchase and sale of rice	7,820.00	770.48	7,049.52	
Locust boards	3,415.00		3,415.00	
Veterinarians and inoculators	30,158.20		30,158.20	
Expenses of serum laboratory	30,519.42	2,871.16	27,648.26	
Pagbilao-Atimonan road	22,308.46	2,816.10	19,492.36	
Relief of Naguilian	655.00		655.00	
Relief of Bohol Province		6,748.97	[a] 6,748.97	
Relief of Laguna Province	5,684.15		5,684.15	
Relief of Romblon Province	250.00		250.00	
Relief of Cavite Province	20,000.00		20,000.00	
Relief of Mariquina fire sufferers	394.01		394.01	
Relief to inhabitants of Samar Province	12,450.67		12,450.67	
Benguet Trail Camp 4 to Baguio	196.60		196.60	
Capas-O'Donnell-Iba road	71,360.99	80.53	71,280.46	
Benguet road	110,493.53		110,493.53	
Padre Juan Villaverde Trail	4,499.82		4,499.82	
Calamba-Los Baños-Bay road	5,258.86		5,258.86	
Bacon-Sorsogon-Bulacan road	286.07		286.07	
Bay-Tiaong road	32,452.42	63.00	32,389.42	
Magdalena road	56,002.15		56,002.15	
Lucena-Sariaya road	5.90		5.90	
Cebu-Toledo road	117,177.52	17.50	117,160.02	
Pasacao-Nueva Caceres road	7,819.69	788.41	7,031.28	
Malolos-Bulacan road	60.41		60.41	
Construction of pier at Calapan, Mindoro	6,000.00		6,000.00	
Construction of Tarlac dike	16,000.00		16,000.00	
Construction of school buildings	259,762.34	10,723.98	249,038.36	
Maintenance of public schools	6,000.00		6,000.00	
School buildings in Samar Province	2,000.00		2,000.00	
Purchase of farm animals for bureau of agriculture	68,685.80		68,685.80	
Removal of municipality of Santa, Ilocos Sur	5,000.00		5,000.00	
Lost property		89.19	[a] 89.19	
Total	926,244.27	92,318.90	833,925.37	1,515,737.82
Net expenditures extended and reducing the insular government's liability				833,925.37
Balance in the fund June 30, 1906, and carried to the balance sheet as an insular government liability				681,812.45

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[a] Excess of refunds.

THE MONEY-ORDER SYSTEM.

DEPARTMENT OF COMMERCE AND POLICE, BUREAU OF POSTS.

The only revenue which accrues from the money-order system is the net amount of fees received after all losses have been deducted therefrom.

An analysis of the money-order statement shows there were balances in the hands of postmasters, June 30, 1905, amounting to $739,937.45, and there was due from former postmasters at that date $2,427.91 and due to former postmasters the sum of $36.18. During the fiscal year 94,261 money orders were issued for the aggregate sum of $3,687,126.81, upon which fees were received amounting to $16,401.44. There was transferred to postal funds $17,895.09, which sum included a balance of fees collected, but not transferred to postal revenues during the preceding fiscal year. The number of orders paid during the fiscal year was 48,380, aggregating $1,923,203.20. There was remitted by the postmaster at Manila to the United States for credit of the Philippine money-order system, on account of money orders of Philippine issue paid in the United States, the sum of $1,550,000. Additional remittances amounting to $325,000 were made during the last quarter of the fiscal year by means of settlement warrants deposited in the insular treasury to the credit of the Treasurer of the United States on money-order account. The sum of $853,021.54, surplus funds covering outstanding money orders, was deposited in the insular treasury by the postmaster at Manila and $3,369.32 was deposited in the insular treasury on account of invalid money orders for the credit of a permanent appropriation from which money orders remaining unpaid more than one year from the last day of the month of issue are payable. There were balances in the hands of postmasters on June 30, 1906, aggregating $94,818.75. There was due from former postmasters June 30, 1906, $3,585.71, while balances due former postmasters that date aggregated $36.18.

Money orders issued in the United States and paid in the Philippine Islands are charged to the United States. Orders issued in the Philippines and paid in the United States are charged to the Philippines. Under this reciprocal arrangement paid orders are respectively transmitted as remittances to the country in which issued.

Appended is a tabulated statement of the money-order transactions during the fiscal year at each of the money-order offices in the islands and a statement of the general account with the United States. The account is stated entirely in United States currency, all transactions of the money-order system being so expressed.

Statement of the money-order business of the post-offices in the Philippine Islands, fiscal year 1906.

DEBIT.

Office.	Balance in the hands of postmasters June 30, 1905.	Balance due from former postmasters June 30, 1905.	Number of orders issued.	Amount of orders issued.	Fees.	Deposits received at Manila from postmasters.	Funds received transferred from Manila.	Balance due former postmasters June 30, 1906.	Total.
Angeles	$62.98		337	$14,453.13	$62.09		$46.00		$14,624.20
Aparri	2,617.09	$1,398.60	1,058	74,831.31	262.71				79,109.71
Bacolod	224.83		978	26,629.51	139.35				26,993.69
Baguio	463.49		1,299	30,640.94	169.94		8,675.00		39,949.37
Balanga	12.96		253	4,193.63	28.09		154.50		4,389.18
Bangued	261.48		161	3,600.93	21.99				3,884.40
Batangas	500.64		2,037	56,810.51	294.73				57,605.88
Bayambang	91.25		685	11,862.44	78.77				12,032.46
Bayombong	850.51		375	6,778.58	42.87				7,671.96
Boac	70.39		378	6,013.58	41.15		270.00	$0.05	6,395.17
Cagayan	466.87	2.03	660	23,175.91	104.68			5.00	23,754.49
Calamba	59.82	988.73	464	8,404.47	52.01		454.71	.03	9,959.77
Calapan	218.53		385	8,924.15	49.19		196.00		9,387.87
Calbayog	274.60		2,170	71,790.35	339.50				72,404.45
Camp Jossman	201.08		884	15,534.34	102.20				15,837.62
Camp Keithley	2,069.63		2,495	78,860.44	378.44				81,308.51
Camp Overton	2,485.02		1,686	53,917.32	265.70				56,668.04
Camp Stotsenburg	35.81		2,552	38,751.41	284.24		500.00		39,571.46
Capiz	1,267.85		1,065	37,887.93	175.47				39,331.25
Catbalogan	558.22		634	19,343.04	93.65				19,994.91
Cavite	1,226.24		2,933	76,598.00	411.76		2,000.00		80,236.00
Cebu	462.80		2,336	72,245.48	354.33				73,062.61
Cervantes	126.99		265	8,210.37	42.17		2,100.00		10,479.53
Corregidor	70.12		15	423.46	2.10				495.68
Cotabato	2,752.57		1,674	101,271.48	370.60				104,394.65
Cuyo	440.87		32	1,437.99	5.92				1,884.78
Daet	156.81		489	9,053.66	58.19				9,268.66
Dagupan	10.85		991	31,112.33	153.37		1,478.18		32,754.73
Davao	1,235.83		414	13,415.16	65.57				14,716.56
Dumaguete	284.77		801	24,249.13	118.69				24,652.59
Fort William McKinley			374	5,073.90	46.27				5,120.17
Iba	63.29		218	5,665.29	31.98				5,760.56
Ilagan	362.04		325	7,814.12	42.87		400.00		8,619.03
Iligan	2,678.36		1,115	87,770.74	301.79				90,750.89
Iloilo	656.58		4,339	194,239.47	798.85		3,500.00		199,194.90
Jolo	1,957.57		2,013	76,341.33	339.54			30.16	78,668.60
Laoag	825.75		891	22,524.58	118.13		1,000.00		24,468.46
Legaspi	809.07	.25	1,853	57,130.45	279.49				58,219.26

Statement of the money-order business of the post-offices in the Philippine Islands, fiscal year 1906—Continued.

DEBIT—Continued.

Office.	Balance in the hands of postmasters June 30, 1905.	Balance due from former postmasters June 30, 1905.	Number of orders issued.	Amount of orders issued.	Fees.	Deposits received at Manila from postmasters.	Funds received transferred from Manila.	Balance due former postmasters June 30, 1906.	Total.
Lingayen	$69.00		799	$16,289.36	$97.03				$16,455.39
Los Baños	24.14		536	11,305.52	67.08		$296.00		11,692.74
Lucena	619.69		1,708	37,721.02	214.08				38,554.79
Malabang	8,784.71		2,337	95,249.35	405.35				104,439.41
Malolos	1.27		313	5,353.48	37.22				5,391.97
Manila	692,586.12		30,198	1,520,600.61	6,272.37	$1,720,735.59			3,940,194.69
Masbate	332.59		323	7,200.32	41.30		5,925.00		13,499.21
Misamis									.64
Nueva Caceres	2,177.99		934	34,161.40	151.55			$0.64	36,490.94
Olongapo	26.67		1,244	27,181.90	161.37		425.00		27,794.94
Ormoc	223.38		959	27,805.28	139.14				28,167.80
Romblon	93.04		201	4,563.66	25.83		275.53		4,958.06
San Fernando, Pampanga	204.83		566	10,924.77	67.38		50.00		11,246.98
San Fernando, Union	50.97		1,325	41,144.50	198.19				41,393.66
San Isidro, Nueva Ecija	96.20		511	16,227.95	80.88		887.00		17,292.03
San Jose, Antique	50.92		324	7,705.05	41.99		273.00		8,070.96
Santa Cruz, Laguna	571.80		477	21,042.48	89.89		97.08		21,801.25
Sorsogon	131.72		610	15,815.48	83.86				16,031.06
Surigao	451.95		466	13,387.48	69.84				13,909.27
Tacloban	1,617.66	$38.30	1,922	64,967.92	302.65			.30	66,926.83
Tagbilaran	333.58		474	14,749.75	77.66				15,160.99
Tarlac	27.32		539	13,368.32	73.46		200.00		13,669.10
Tuguegarao	109.85		705	29,706.09	126.11				29,942.05
Twin Peaks	140.56		3	92.50	.46				233.52
Vigan	219.57		956	36,010.77	161.89				36,392.23
Zamboanga	4,078.36		4,197	227,570.99	886.47				232,535.82
Grand total	739,937.45	2,427.91	94,261	3,687,126.81	16,401.44	1,720,735.59	29,203.00	$36.18	6,195,868.38

Statement of the money-order business of the post-offices in the Philippine Islands, fiscal year 1906—Continued.

CREDIT.

Office.	Number of orders paid and repaid.	Amount of orders paid and repaid.	Amount deposited at Manila.	Transferred from Manila to other offices.	Transferred to postal funds.	Credit to postmaster Manila for remittances to United States.	Surplus money-order funds deposited in treasury.	Deposited in treasury account of invalid money-orders.	Balance due former postmasters June 30, 1905.	Balance due from former postmasters June 30, 1906.	Balance due the Government June 30, 1906.	Total.
Angeles	42	$843.94	$13,624.80		$62.09						$93.37	$14,624.20
Aparri	99	3,510.99	68,190.32		262.71					$1,398.60	5,747.09	79,109.71
Bacolod	132	3,865.54	22,480.29		139.35						508.51	26,993.69
Baguio	351	20,982.84	18,763.69		169.94						32.90	39,949.37
Balanga	40	983.93	3,369.16		28.09						8.00	4,389.18
Bangued	33	592.40	2,976.01		21.99						294.00	3,884.40
Batangas	380	12,931.31	43,813.59		294.73						566.25	57,605.88
Bayambang	63	1,165.56	10,769.82		78.77						18.31	12,032.46
Bayombong	24	463.11	7,027.53		42.87						138.45	7,671.96
Boac	31	924.89	5,378.07		41.15				$0.05		51.01	6,395.17
Cagayan	93	2,897.55	19,697.02		104.66				5.00	1.90	1,048.36	23,754.49
Calamba	93	1,358.57	7,478.43		52.01				.03	988.73	82.00	9,959.77
Calapan	57	1,713.23	7,578.18		49.19						47.27	9,387.87
Calbayog	184	7,393.43	63,746.95		339.50						924.57	72,404.45
Camp Jossman	130	3,596.66	11,678.16		102.20						460.60	15,837.62
Camp Keithley	341	15,229.28	63,868.61		378.44						1,832.18	81,308.51
Camp Overton	355	16,170.26	38,452.00		265.70						1,780.08	56,668.04
Camp Stotsenburg	192	5,885.57	32,593.01		284.21						808.67	39,571.46
Capiz	142	7,489.64	31,191.15		175.47						474.99	39,331.25
Catbalogan	74	1,721.99	17,855.87		44.82						372.23	19,994.91
Cavite	877	30,601.70	48,640.49		411.78						582.03	80,236.00
Cebu	893	37,062.15	34,403.32		354.29						1,242.85	73,062.61
Cervantes	83	5,253.92	3,054.99		42.17						2,128.45	10,479.53
Corregidor	4	154.77	340.91									495.68
Cotabato	148	5,092.20	94,207.68		370.60						4,724.17	104,394.65
Cuyo	2	75.50	1,809.28									1,884.78
Daet	37	881.78	7,364.97		58.19						963.72	9,268.66
Dagupan	399	11,403.08	20,608.47		153.37						589.81	32,754.73
Davao	139	9,164.01	5,104.52		65.59					26.69	355.75	14,716.56
Dumaguete	160	9,331.31	15,184.40		118.69						18.19	24,652.59
Fort William McKinley	14	198.16	4,850.84		46.27						24.90	5,120.17
Iba	41	756.53	4,797.05		31.98						175.00	5,760.56
Ilagan	46	1,612.87	5,263.68		42.87					1,131.24	568.37	8,619.03
Iligan	219	8,841.68	79,162.00		301.79						2,445.42	90,750.89
Iloilo	1,654	54,597.66	142,928.67		798.67						869.90	199,194.90
Jolo	410	18,978.87	58,066.94		339.54				30.16		1,253.09	78,668.60
Laoag	188	8,661.21	14,891.66		118.13						797.46	24,468.46

Statement of the money-order business of the post-offices in the Philippine Islands, fiscal year 1906—Continued.

CREDIT—Continued.

Office.	Number of orders paid and repaid.	Amount of orders paid and repaid.	Amount deposited at Manila.	Transferred from Manila to other offices.	Transferred to postal funds.	Credit to postmaster Manila for remittances to United States.	Surplus money-order funds deposited in treasury.	Deposited in treasury account of invalid money-orders.	Balance due former postmasters June 30, 1905.	Balance due from former postmasters June 30, 1906.	Balance due the Government June 30, 1906.	Total.
Legaspi	299	$12,868.02	$44,607.79		$279.49					$0.25	$463.71	$58,219.26
Lingayen	127	4,627.18	11,710.30		97.03						20.88	16,455.39
Los Baños	112	3,210.60	8,321.67		67.08						93.39	11,692.74
Lucena	185	6,154.84	31,954.55		214.08						231.32	38,554.79
Malabang	191	5,751.39	94,195.32		405.35						4,087.35	104,439.41
Malolos	50	845.16	4,491.34		37.22						18.25	5,391.97
Manila	36,105	1,455,099.89		$29,203.00	7,852.98	$1,550,000.00	$853,021.54	$3,369.32			41,647.96	3,940,194.69
Masbate	121	8,667.60	4,474.60		41.30						315.71	13,499.21
Misamis									$0.64			.64
Nueva Caceres	164	4,429.08	30,993.92		151.55						916.39	36,490.94
Olongapo	204	4,984.13	22,368.08		161.37						281.36	27,794.94
Ormoc	118	3,337.49	24,261.18		139.14						429.99	28,167.80
Romblon	37	1,048.55	3,830.68		20.05						58.78	4,958.06
San Fernando, Pampanga	106	2,124.68	8,725.03		67.38						329.89	11,246.98
San Fernando, Union	256	12,851.99	26,927.68		198.17						1,415.82	41,393.66
San Isidro, Nueva Ecija	133	4,457.12	12,511.00		80.88						243.03	17,292.03
San Jose, Antique	40	1,416.73	6,453.79		41.99						158.45	8,070.96
Santa Cruz, Laguna	100	2,331.30	18,597.64		66.27						806.04	21,801.25
Sorsogon	64	1,589.39	14,322.66		83.86						35.15	16,031.06
Surigao	27	569.53	12,761.91		69.84						507.99	13,909.27
Tacloban	259	9,325.12	56,808.44		302.65				.30	$38.30	452.02	66,926.83
Tagbilaran	25	821.61	13,030.52		77.66						1,231.20	15,160.99
Tarlac	132	4,926.08	8,495.47		73.46						174.09	13,669.10
Tuguegarao	99	3,145.06	25,904.73		126.11						766.15	29,942.05
Twin Peaks	2	11.60	221.92									233.52
Vigan	222	7,814.57	26,963.41		161.89						1,452.36	36,392.23
Zamboanga	1,032	48,406.40	176,589.43		886.47						6,653.52	232,535.82
Grand total	48,380	1,923,203.20	1,720,735.59	29,203.00	17,895.09	1,550,000.00	853,021.54	3,369.32	$36.18	3,585.71	94,818.75	6,195,868.38

Recapitulation of money-order business.

Character of item.	Debit.	Credit.
Balance in the hands of postmasters June 30, 1905	$739,937.45	
Amount due from former postmasters June 30, 1905	2,427.91	
Amount received for money orders issued	3,687,126.81	
Amount received for fees on money orders issued	16,401.44	
Surplus funds received at Manila from postmasters	1,720,735.59	
Amount received from Manila by provincial postmasters	29,203.00	
Amount due former postmasters June 30, 1906	36.18	
Amount of money orders paid		$1,923,203.20
Surplus funds transmitted to Manila by postmasters		1,720,735.59
Amount transferred from Manila to other offices		29,203.00
Amount transferred to postal funds		17,895.09
Amount remitted to the United States by postmaster at Manila		1,550,000.00
Surplus money-order funds deposited in treasury		853,021.54
Amount deposited in treasury on account of invalid money orders		3,369.32
Amount due former postmasters June 30, 1905		36.18
Amount due from former postmasters June 30, 1906		3,585.71
Balance in the hands of postmasters June 30, 1906		94,818.75
Total	6,195,868.38	6,195,868.38

General account of the money-order transactions between the Philippine Islands and the United States.

Character of item.		Debit.	Credit.
Balance due United States June 30, 1905		$7,054.85	
Philippine orders paid in the United States, fiscal year 1906:			
First quarter	$500,645.48		
Second quarter	674,347.81		
Third quarter	446,119.14		
Fourth quarter	532,338.36		
		2,153,450.79	
United States orders paid in the Philippines, fiscal year 1906:			
First quarter	29,156.06		
Second quarter	39,954.98		
Third quarter	47,063.77		
Fourth quarter	41,128.97		
			$157,303.78
Cash remitted to the United States, fiscal year 1906:			
First quarter	275,000.00		
Second quarter	475,000.00		
Third quarter	600,000.00		
Fourth quarter	525,000.00		
			1,875,000.00
Balance due United States June 30, 1906			128,201.86
Total		2,160,505.64	2,160,505.64

OTHER RESOURCES AND LIABILITIES.

In the following statements of account is shown the relation of the insular government to the several special funds arising from the issue of bonds for specific purposes, and to the several quasi trust funds held pending claim for refund after the conditions of the law have been complied with.

These statements are omitted from the regular account of insular receipts and expenditures, as they do not affect the income or expenditures of the insular government in any manner until covered into general funds as revenue by reason of noncompliance with the specific provisions of the law authorizing refunds within given periods.

In the case of bond issues for specific purposes the full amount of principal and premium derived from the sale of bonds is credited to the fund, and it is charged with the par value of the issue, for the reason that the insular government assumes the obligation and carries same under the account of bonded indebtedness. In several cases sinking funds have been created for redemption of bond issues at maturity. Payments for this purpose are charged as expense and carried as liabilities under the respective sinking funds.

The cash balances on said accounts are included in the insular treasurer's account and in the balances in the hands of collecting and disbursing officers. For every item of revenue received on account of a special fund the liability of the insular government is increased, and for every expenditure there is a corresponding decrease.

THE GOLD-STANDARD FUND.

Debits to the insular government.

Balance due the fund on June 30, 1905, and representing the net gain of the fund to that date		₱865,112.42
Receipts during the fiscal year 1906:		
Coinage account, including mint receipts, proof sets, sale of copper, and miscellaneous items	₱1,751,895.38	
Premium on sale of New York exchange	140,978.85	
Interest on fund deposits	155,393.66	
Gain in exchange of Mexican and Spanish-Filipino currency at the arbitrary ratio of 1.30 to 1 (see treasurer's cash account for actual currencies)	13,067.85	
Total receipts		2,061,335.74
Proceeds of fifth series, certificates of indebtedness		3,049,200.00
Amount paid in redemption of fourth series certificates of indebtedness (see bonded indebtedness for contra credit)		6,000,000.00
Total		11,975,648.16

Credits to the insular government.

Expenditures during the fiscal year: Coinage account, including purchases of bullion and alloy, insurance, transportation, and Mexican currency shipped to United States mints for recoinage	₱654,529.72
Value of fifth series, certificates of indebtedness (see bonded indebtedness for contra charge)	3,000,000.00
Redemption of fourth series, certificates of indebtedness (see bonded indebtedness for contra charge)	6,000,000.00
Interest on certificates of indebtedness	150,160.00
Total	9,804,689.72
Net liability of the insular government and representing gain to the fund to June 30, 1906	2,170,958.44

LOANS TO PROVINCES.

Following is a statement of the balances due from provinces on account of loans from the insular government on June 30, 1905, the loans made to provinces during the fiscal year 1906, the loans paid during the same period, and the balances due from provinces on this account on June 30, 1906, both to the insular government and to the Congressional relief fund. Loans specifically made in Mexican and Spanish-Filipino currency have been reduced to Philippine currency at the ratio of 1.30 to 1, which was the ratio when the former currency ceased to be received by the insular government in payment of debts and obligations.

Province.	Balance due government June 30, 1905.	Loans made during fiscal year.		Loans paid during fiscal year.		Balance due government June 30, 1906.
		Insular government.	Congressional relief fund.	Insular government.	Congressional relief fund.	
Albay	₱90,000.00	₱35,000.00				₱125,000.00
Antique	22,500.00					22,500.00
Abra	10,000.00		₱6,000.00	₱9,653.85		6,346.15
Ambos Camarines	50,000.00					50,000.00
Batangas	63,300.00			11,635.53		51,664.47
Bataan		6,000.00				6,000.00
Bohol			18,383.71			18,383.71
Bulacan	10,000.00					10,000.00
Capiz	70,000.00			15,000.00		55,000.00
Cavite	68,461.53					68,461.53
Cebu	60,000.00	25,000.00				85,000.00
Iloilo	50,000.00					50,000.00
Ilocos Sur	20,000.00				₱6,666.67	13,333.33
Masbate	5,000.00			5,000.00		
Mindoro	5,000.00					5,000.00
Nueva Ecija	27,000.00					27,000.00
Occidental Negros	20,000.00			4,000.00		16,000.00
Oriental Negros		20,000.00				20,000.00
Palawan (formerly Paragua)	20,615.38			20,615.38		
Pangasinan	5,000.00					5,000.00
Rizal	5,000.00			5,000.00		
Romblon	6,000.00					6,000.00
Samar	19,230.77	25,000.00				44,230.77
Sorsogon	20,000.00					20,000.00
Surigao	4,000.00			4,000.00		
Tarlac		50,000.00				50,000.00
Tayabas	10,085.00					10,085.00
Union	37,000.00					37,000.00
Zambales	10,000.00					10,000.00
Total	708,192.68	161,000.00	24,383.71	74,904.76	6,666.67	812,004.96

THE FRIAR LANDS FUND.

Under authority of sections 63, 64, and 65 of the act of Congress of July 1, 1902, the Philippines government was empowered to issue bonds for the purpose of providing funds to acquire by purchase certain lands in the Philippine Islands generally known as the friar lands. The operations under the fund derived from the sale of bonds and collections from rental of the lands after purchase during the fiscal year 1906 were as follows:

Balance due the insular government July 1, 1905		₱5,778,996.50
Receipts during the fiscal year, rental of lands	₱98,661.30	
Expenditures during the fiscal year:		
Final payment on purchase of lands	7,043,314.00	
Transfer to friar lands bond sinking fund	50,000.00	
Interest on bonds, including telegraphic transfer of funds	138,090.00	
Compensation to special counsel and title examiners	11,916.68	
Total	7,243,320.68	
Excess of expenditures		7,144,659.38
Total carried as an insular government asset, being the difference between the aggregate of cash in the treasury and in the hands of disbursing officers belonging to the fund and the amount of insular government's liability on the bond issue		12,923,655.88

FRIAR LANDS BOND SINKING FUND.

Under section 23 of act No. 1120 it is provided that all moneys derived from the leasing and sale of the lands sold to the government and known as the friar lands, or from deferred payments thereon, shall be deposited in the insular treasury and held as a trust fund for the payment of the principal and interest of the bonds issued for the purpose of acquiring the said lands. It is further provided that said moneys shall also constitute a sinking fund for the redemption of the bonds at maturity, with provisions for the investment and reinvestment of the moneys. All receipts during the fiscal year have been taken up under the friar lands fund and periodically covered into the sinking fund account. Up to June 30, 1906, the sum of ₱50,000 has been so transferred, and this sum constitutes a liability of the insular government covered by cash in the possession of the insular treasurer and included in his balance as such. The fund is insufficient as yet to meet the interest charges and same has been paid from insular funds as provided for in the act referred to.

MORO PROVINCE.

Following is a statement of the transactions of the Moro Province as they affect insular fiscal affairs. The customs revenues arising in the province accrue to and are deposited in the provincial treasury. During the first half of the fiscal year the expenses of the customs service in the province were paid originally from the insular treasury, which is reimbursed on settlement of the insular accounts. The new accounting act (act No. 1402), however, confines these transactions to the Moro treasury, and all expenditures during the latter half of the year have been so made, although given in the aggregate in this statement:

Debits.

Balance due insular government July 1, 1905		₱55,222.39
Expenditures during the fiscal year:		
Salaries and wages	₱43,207.10	
Contingent expenses	6,550.26	
Arrastre plant	649.65	
Extra services of employees	224.60	
Total expenditures		50,631.61
Amounts credited to customs officers and deposited in Moro treasury		321,834.38
Total debits		427,688.38

Credits.

Customs revenues collected during the fiscal year:		
Duties on merchandise imported	₱295,797.89	
Duties on merchandise exported	5,122.56	
Wharfage	5,212.56	
Tonnage	4,479.12	
Storage, labor, and drayage	260.43	
Fines, penalties, and forfeitures	608.40	
Licenses	860.96	
Sales of customs stamps	3,780.40	
Sales of rolls	20.00	
Sales of blank forms	202.37	
Immigration tax	996.00	
Miscellaneous fees	1,157.00	
Extra services of customs employees	209.50	
Arrastre plant	1,936.17	
Total revenue		320,643.36
Accountable warrants issued on Moro treasury		26,413.10
Total credits		347,056.46
Balance carried as an insular government asset		80,631.92

PUBLIC WORKS AND PERMANENT IMPROVEMENT FUND.

Under authority of the Congress of the United States the Philippines government is authorized to issue bonds for certain specific purposes, including public works and permanent improvements. A statement of the various bond issues to date is given on page 245.

The operations under the first and second issues of insular public works and permanent improvement bonds during the fiscal year were as follows:

Balance due the insular government July 1, 1905		₱972,759.38
Par value of second issue of bonds, elsewhere carried as an insular government liability and here charged against the fund as an offset to said amount		2,000,000.00
Amounts expended during the year for the purposes of the bond issue:		
Improvement of the port of Manila and Pasig River	₱1,591,190.55	
Improvement of the port of Cebu	240,671.78	
Improvement of the port of Iloilo	173,875.49	
Quarantine station at Cebu	15,660.06	
Improvement of Bilibid prison and stone quarry	40,680.63	
Improvement of Pasig River front	272,605.80	
Calamba-Los Baños-Bay road	52,438.22	
Public works, miscellaneous	40,643.38	
Wright-Taft road	75,084.79	
Light-house construction	139,885.31	
Improvement of Engineers Island	12,129.13	
Benguet improvements	16,295.86	
Maintenance of survey parties	17,824.60	
Baguio-Trinidad road	642.15	
Total expenditures		2,689,627.75
Total charges		5,662,387.13
Amount of principal and premium resulting from the sale of second issue of bonds		2,167,494.00
Balance carried as an insular government asset, being the difference between cash in the treasury belonging to the fund added to balances in the hands of disbursing officers and the amount of insular government's liability on the bond issue		₱3,494,893.13

SEWER AND WATERWORKS CONSTRUCTION FUND, CITY OF MANILA.

Balance due the fund July 1, 1905, being the proceeds of first issue of bonds	₱2,191,250.00
Expenditures during the fiscal year for general purposes of sewer and waterworks construction, including transfer to City of Manila expenditures for preliminary expenses incurred prior to issue of bonds	600,620.35
Balance carried as an insular government liability and covered by cash in the treasury and balances in the hands of disbursing officers	₱1,590,629.65

MANILA SEWER AND WATERWORKS BOND SINKING FUND.

Under section 6 of act No. 1323 there is created a permanent annual charge against the city of Manila of ₱38,740 for the purpose of constituting a sinking fund for the redemption at maturity of the bonds issued for the purpose of providing funds to construct sewers and supplying water in the city of Manila. This sum has been transferred for the current year and appears under the expenditures of the city of Manila. The amount is carried as a liability of the insular government and is included in the insular treasurer's cash balance under the designation given.

REFUNDABLE INTERNAL REVENUE.

Full detailed information as to internal revenue collections and refund to provinces and municipalities under the provisions of act No. 1189 will be found elsewhere in the report under the half title "Other fiscal information." An account is maintained on the books of this office entitled "Refundable internal revenue," to which is charged all collections in the provinces which are to be subsequently refunded in accordance with the scheme of distribution outlined in the act referred to, and to which credit is given when the refunds are made. The following table will show the transactions in the aggregate for the fiscal year 1906:

Balance due July 1, 1905	₱447,342.64
Collections during the fiscal year	1,808,869.68
Total	2,256,212.32
Refunded during the fiscal year	1,624,206.58
Balance due provinces and municipalities June 30, 1906, and carried to the balance sheet as an insular government liability	632,005.74

REFUNDABLE EXPORT DUTIES.

Under the provisions of an act of Congress approved March 8, 1902, certain export duties are collected in the Philippines and deposited in the insular treasury, subject to refund to the parties from whom received, upon compliance with specific requirements. These moneys are in a sense trust funds and are so considered until eighteen months from the date of collection, when, under ruling of the Secretary of War, they are transferable to the general revenue of the insular government. (See p. 205.)

Amount held July 1, 1905, subject to claim		₱910,923.46
Collected during the fiscal year		868,428.02
Total		1,779,351.48
Refunded during the fiscal year	₱838,571.50	
Covered into customs revenues as not claimed within legal period	127,416.78	
Total		965,988.28
Balance held June 30, 1906, and carried as a liability of the insular government		813,363.20

OUTSTANDING LIABILITIES.

Rule 31 of act No. 90 provides that no disbursing officer's check shall be paid after one year from the last day of the month of its issue. In every case where after one year after the rendition and settlement of the final account of a disbursing officer there remains a balance in any depository to the credit of such disbursing officer, by reason of the nonpresentation of checks or otherwise, the auditor reports said amounts to the governor-general, who requires the depositary to deposit the said balance with the treasurer of the islands to the credit of "outstanding liabilities."

Section 47 of act No. 1402 extends to two years the time within which a disbursing officer's check may be presented, and sections 47 to 53 of the same act modify the provisions previously imposed by rule 31 of act No. 90.

Amount held July 1, 1905, subject to claim	₱7,523.52
Covered in during the fiscal year	4,578.25
Total	12,101.77
Refunded during the fiscal year	5,068.76
Balance held June 30, 1906, and carried as a liability of the insular government	7,033.01

REFUNDABLE SURPLUS ON CUSTOMS AUCTION SALES.

Under section 283 of the customs administrative act the proceeds of sales of unclaimed merchandise are held as a special trust deposit for one year thereafter, and, if unclaimed during that period, thereupon covered into the general fund as customs receipts.

Amount held July 1, 1905, subject to claim	₱4,221.90
Surplus collected during the fiscal year	326.86
Total	4,548.76

Refunded during the fiscal year	₱1,574.10	
Covered into customs receipts as not claimed within legal period	2,555.19	
Total		₱4,129.29
Balance held June 30, 1906, and carried as a liability of the insular government		419.47

PROVINCIAL GOVERNMENTS.

For the purpose of maintaining a record of the liability of provincial treasurers and incorporating same into the general scheme of bookkeeping followed in this office all collections in the provinces are charged to the provincial treasurer and credited to the province. Payments are treated as a credit to the treasurer and a charge against the province. The difference is therefore carried as an insular government liability in favor of the provinces with a corresponding asset consisting of balances in the hands of provincial treasurers. The account is purely per contra for the purpose mentioned. Full details as to provincial accounts are treated elsewhere in the report. The insular government's liability on this account aggregated ₱2,476,368.89 on June 30, 1906, all items of Mexican or Spanish-Filipino currency having first been reduced at the ratio of 1.30 to 1, and included in the Philippines currency expression:

Bonded indebtedness.

Description.	Outstanding July 1, 1905.	Issues in the fiscal year.	Redemptions in the fiscal year.	Outstanding June 30, 1906.
Fourth series, certificates of indebtedness due Sept. 1, 1905, interest 4 per cent per annum, payable quarterly	₱6,000,000		₱6,000,000	
Friar lands bonds, due Feb. 1, 1934, but redeemable at the pleasure of the insular government after ten years from Feb. 1, 1904, interest 4 per cent per annum, payable quarterly	14,000,000			₱14,000,000
Public works and permanent improvement bonds, due Mar. 1, 1935, but redeemable at the pleasure of the insular government after ten years from Mar. 1, 1905, interest 4 per cent per annum, payable quarterly	5,000,000			5,000,000
City of Manila sewer and waterworks construction bonds, due June 1, 1935, but redeemable at the pleasure of the city of Manila after ten years from June 1, 1905, interest 4 per cent per annum, payable quarterly	2,000,000			2,000,000
Fifth series, certificates of indebtedness due Sept. 1, 1906, interest 4 per cent per annum, payable quarterly		₱3,000,000		3,000,000
Public works and permanent improvement bonds, due Feb. 1, 1936, but redeemable at the pleasure of the insular government after ten years from Feb. 1, 1906, interest 4 per cent per annum, payable quarterly		2,000,000		2,000,000
Total	27,000,000	5,000,000	6,000,000	26,000,000

While the amount of bonds outstanding is carried as an insular government liability, a corresponding asset exists in the amount of the issues having been charged per contra to the special fund originally credited with the proceeds of the issue. (See pp. 240–243.)

OUTSTANDING POSTAL DRAFTS.

Amount of postal drafts outstanding July 1, 1905	₱10,418.04
Amount of postal drafts issued on the postmaster of Manila in favor of and charged to postmasters during the fiscal year	109,391.04
	119,809.08
Amount of postal drafts paid by postmaster of Manila during the fiscal year	103,485.78
Balance outstanding June 30, 1906, and carried as a liability of the insular government	16,323.30

OUTSTANDING WARRANTS.

Following is a statement, by currencies, of warrants outstanding on July 1, 1905, the amounts issued, paid and canceled during the fiscal year, and the amount outstanding June 30, 1906:

	Philippines currency.	Mexican and Spanish-Filipino currency.
Outstanding July 1, 1905	₱95,331.88	Pfs. 21.43
Covered into Philippines currency by arbitrary expression	16.48	
Issued on the insular treasurer during the fiscal year	52,187,852.66	745,507.00
Total	52,283,201.02	745,528.43
Paid by the insular treasurer during the fiscal year	52,186,385.58	745,507.00
Covered into Philippines currency by arbitrary expression		21.43
Canceled during the fiscal year	563.67	
Total	52,186,949.25	745,528.43
Balance outstanding June 30, 1906, and carried as an insular government liability	96,251.77	

INVALID MONEY ORDERS.

Under the rules of the money-order system an order becomes invalid for direct payment twelve months after the last day of the month of issue. The amounts received from the issuance of money orders which have become invalid are deposited in the insular treasury and are made a permanent refundable appropriation by the provisions of paragraph 8, section 1, of act 357, for the payment of the amount of the original orders by warrant upon certification of the claims by the auditor.

Amount held July 1, 1905, subject to claim as above	₱5,024.80
Deposit in the insular treasury during the fiscal year	6,958.64
	11,983.44
Refunded by settlement warrant during the fiscal year	7,535.70
Balance held June 30, 1906, and carried as a liability of the insular government	4,447.74

UNITED STATES MONEY ORDER ACCOUNT.

Balance due United States July 1, 1905	$7,054.85
Amount paid by United States in redemption of money orders issued in Philippine Islands	2.153,450.79
Total	2,160,505.64
Amount paid by insular government in redemption of money orders issued in United States	157,303.78
Amount remitted to United States Government in settlement of international balances	1,875,000.00
Total	2,032,303.78
Balance due United States June 30, 1906	128,201.86
Total	2,160,505.64

Expressed in United States currency. For detailed statement see pp. 234–239.

PHILIPPINES MONEY ORDER ACCOUNT.

Balances July 1, 1905:		
Amounts due by postmasters	$741, 329. 18	
Less amount due on United States account	7, 054. 85	
		$734, 274. 33
Amounts received from money orders issued	3, 687, 126. 81	
Amount received from fees on money orders issued	16, 401. 44	
Amount paid on United States money orders redeemed	157, 303. 78	
		3, 860, 832. 03
Total		4, 595, 106. 36
Amount paid on money orders redeemed	1, 923, 203. 20	
Amount of money-order fees transferred to postal revenues	17, 895. 09	
Amount paid by the United States Government on Philippines money orders redeemed	2, 153, 450. 79	
Amount transferred to invalid money order fund	3, 369. 32	
		4, 097, 918. 40
Balances June 30, 1906:		
Amounts due by postmasters	97, 368. 28	
Surplus funds on deposit with insular treasurer	528, 021. 54	
	626, 389. 82	
Less amount due on United States account	128, 201. 86	
		497, 187. 96
Total		4, 595, 106. 36

Expressed in United States currency. For detailed statements see pp. 234–239.

ACCOUNTS OF THE INSULAR TREASURER AS DEPOSITARY.

Under the provisions of section 85 of the act of Congress of July 1, 1902, temporarily providing for the administration of affairs of civil government in the Philippine Islands, the insular treasurer has been designated as a depositary of funds of the United States, consisting of the funds of the United States Army and Navy disbursing officers serving in the Philippine Islands and on the Asiatic Station, respectively, and funds to the credit of the Treasurer of the United States as repayments, miscellaneous, and United States money-order funds.

Under the provisions of act No. 758, the insular treasurer is likewise designated a depositary of insular disbursing officers' funds and of all trust funds coming into the hands of officers of the insular government as such.

The following summary shows balance on hand July 1, 1905, receipts, withdrawals, and transfers during the fiscal year, and balances on hand June 30, 1906. The latter sum is carried to the balance sheet as a liability and is offset by a corresponding asset consisting of cash in the hands of the insular treasurer. Mexican and Spanish-Filipino currency transactions are arbitrarily stated at the official ratio of 1.30 to 1.

Account.	Balance due July 1, 1905.	Receipts.	Withdrawals and transfers.	Balance due June 30, 1906.
Army and Navy disbursing officers	₱3, 794, 179. 05	₱50, 813, 965. 72	₱50, 497, 240. 74	₱4, 110, 904. 03
Treasurer of the United States	3, 364, 882. 80	23, 791, 356. 52	24, 776, 812. 20	2, 379, 427. 12
Philippine disbursing officers and provincial treasurers	3, 998, 080. 29	49, 665, 948. 765	49, 026, 504. 255	4, 637, 524. 80
Philippine money-order funds	1, 314, 593. 57	3, 276, 141. 66	4, 590, 735. 23	....
Assurance fund, act No. 496	6, 339. 31	6, 512. 91	12, 852. 22	....
Constabulary relief fund, act No. 619	55, 371. 19	22, 510. 89	77, 939. 33	[a] 57. 25
Franchise deposits	114, 600. 00	71, 000. 00	95, 600. 00	90, 000. 00
Fidelity deposits	55, 600. 00	700. 00	55, 600. 00	700. 00
Total	12, 703, 646. 21	127, 648, 136. 465	129, 133, 283. 975	11, 218, 498. 70

[a] Excessive transfer. Refunded in fiscal year 1907.

SILVER CERTIFICATES REDEMPTION FUND.

This fund is carried as a liability of the insular government to the holders of silver certificates issued and placed in circulation. Simultaneous with the issue a corresponding sum in currency is placed in reserve for redemption. See insular treasurer's cash account for corresponding cash asset.

The following table will show the course of circulation during the fiscal year. No redemptions have as yet been made:

	Twos.	Fives.	Tens.	Total.
Outstanding July 1, 1905	₱1,500,000.00	₱1,750,000.00	₱7,200,000.00	₱10,450,000.00
Issued during year	290,000.00	70,000.00	3,600,000.00	3,960,000.00
Outstanding June 30, 1906, and carried as a per contra asset and liability as above	1,790,000.00	1,820,000.00	10,800,000.00	14,410,000.00

UNISSUED SILVER CERTIFICATES.

As directed by law an account is maintained on the books of this office for the purpose of showing the unissued silver certificates on hand, and the denomination and serial numbers thereof. This account is purely per contra, the value of the certificates being carried as a liability with a corresponding asset in a charge on special property account against the insular treasurer, their legal custodian.

The following table will show the value of certificates issued during the year by denominations, with the respective opening and closing balances. For obvious reasons the serial numbers are not revealed.

	Twos.	Fives.	Tens.	Total.
On hand July 1, 1905	₱1,500,000.00	₱4,250,000.00	₱3,800,000.00	₱9,550,000.00
Issued during the year	290,000.00	70,000.00	3,600,000.00	3,960,000.00
On hand June 30, 1906, and carried as a per contra asset and liability as above stated	1,210,000.00	4,180,000.00	200,000.00	5,590,000.00

BALANCES IN THE HANDS OF COLLECTING AND DISBURSING OFFICERS AND PROVINCIAL TREASURERS.

On June 30, 1906, the sum of ₱4,804,418.92 remained in the hands of collecting and disbursing officers and provincial treasurers subject to subsequent deposit in the insular treasury and for future disbursement. This sum represents the official balances as shown by auditor's certificates, and includes credits in suspense in the settlement of accounts.

The amount is segregated as follows:

Insular and special funds	₱2,328,050.03
Provincial funds	2,476,368.89
Total	4,804,418.92

All balances in Mexican and Spanish-Filipino currency have been reduced at the official ratio of 1.30 to 1 and included in the Philippines currency expression.

MISCELLANEOUS SPECIAL FUNDS.

For the purpose of maintaining a complete record of all funds in the hands of government officials, aside from ordinary receipts and expenditures, an account is maintained under the above caption and comprises all special funds not otherwise covered in this report. The several balances in each fund on June 30, 1906, were as follows:

Constabulary relief fund	₱80, 827. 63
Rizal monument fund	112, 623. 75
Estates of deceased government employees	16, 961. 11
Municipal board fund	1, 164. 84
Fire line badge fund	336. 00
Bilibid prisoner's trust fund	1, 588. 01
Contractor's trust fund	1, 203. 00
Title deposits	18, 050. 00
Assurance fund	13, 517. 11
Opium fund	53, 206. 28
Total liability of the insular government and covered by cash in the treasury and balances in the hands of collecting and disbursing officers	299, 477. 73

PROVINCIAL AND MUNICIPAL ACCOUNTS.

During the fiscal year radical changes have been made in the manner of auditing provincial and municipal accounts.

By the accounting act, enacted October 10, 1905, and which became effective in provincial accounting as its operations could be extended over the various provinces, not later than June 30, 1906, there was created a corps, consisting of a chief district auditor and such number of district auditors as might be detailed from the authorized personnel of the bureau, for the purpose of auditing the provincial accounts. This auditing is now done within the respective provinces, instead of in Manila as before. The system was extended to the various provinces as rapidly as practicable, and at the end of the fiscal year was established in all except Mindoro, Zambales, Surigao, and Misamis. With the beginning of the fiscal year 1907 these provinces were included in the district system. The auditor has been somewhat handicapped in the inauguration of the system by the lack of a sufficient number of men of the requisite ability and experience to do the work, and, until the passage of the appropriation bill for the fiscal year now current, by a salary list which did not admit of securing men of such experience and ability.

The work of auditing is one which requires for its basis technical training and experience, besides especial training for a time under competent and direct supervision. The difficulty of creating out of hand a force of men for such work in the field, where men must act largely upon their own initiative and judgment, and at once, is very obvious. Still, handicapped as the work has been in these respects, the auditing of provincial accounts is at this time further advanced than ever before at a corresponding period, and the work is being done very effectively. The crying and insistent need, however, is for men of the ability, experience, and general business judgment which these positions require and for which the salaries are now provided.

It is the ultimate intention to divide the islands into seventeen auditing districts. By combining several of the prospective districts they are now divided into thirteen, owing to inability to secure suitable men for the positions to be filled.

The auditing of provincial property accounts was placed upon the district auditors beginning July 1, 1906, and this, with the necessity for more frequent field examinations of insular accounts in the provinces, will make the increase of districts to the number planned imperative at an early date.

By act No. 1482, passed May 1, 1906, the audit of municipal accounts was placed under the district auditors, with the same jurisdiction and supervision on the part of the insular auditor as he exercises by law over provincial accounts. The act, as far as it relates to this auditing, was made effective from January 1, 1906, the beginning of the municipal fiscal year. The work is already well under way. The advantage of the change from the system of auditing these accounts for their respective provinces by 38 provincial treasurers, is already conclusively apparent in many ways. From the provincial treasurers themselves and from those conversant with the conditions in the municipalities have come statements of the beneficial results of the change. It is believed that this will prove to be one of the best pieces of accounting legislation the Commission has enacted.

Including the various organizations in the special government-act provinces, there are 625 municipal organizations in the islands, whose aggregate annual expenditures are approximately ₱4,800,000. By a utilization of the Filipino clerk allowed the district auditors in each of the more important provinces of the islands, under the provisions of act No. 1416, and the authority given the district auditors by act No. 1482 to deputize the traveling deputies of the provincial treasurers as their deputies for field examinations, this important work will be accomplished with practically no increased expense to the insular government. True, this additional work makes more imperative the increase in the number of districts to seventeen, but this number was intended to be established in any event, as the work of provincial auditing could not well continue to be handled with a lesser number. The very essence of the advantage of the district system of provincial auditing is the greater effectiveness gained by actual knowledge of the conditions, persons, and places having to do with the accounts being examined. This advantage would be lessened with the continuance of districts covering too great a number of provinces.

At intervals certain accounts audited by district auditors are selected for reaudit in this office under the direct supervision of the chief district auditor. This serves as a check upon the thoroughness and efficiency with which the auditing is being carried on in the various districts.

The reorganization act, which became effective November 1, 1905, placed with the bureau of audits the duty of conducting all field examinations of accounts and such administrative examinations as might be called for from time to time, the traveling examiners before employed by the bureaus of the insular treasury, posts, constabulary, and customs being discontinued. The district auditors have been utilized for this work. It was expected when the work was taken over that at least a part of the examiners of the bureaus named would be transferred to this bureau. With the exception of a portion of the force employed by the treasury, however, none were transferred, and this office has had to rely upon its own efforts to secure and train the men needed for the purpose. As before stated, and it will bear repetition, our greatest and most urgent need is men of the required experience and ability to carry on this district work, and that which is said of this phase of the accounting work, applies with almost equal force to the work of the bureau as a whole.

PAYMENTS TO PROVINCES IN LIEU OF THE LAND TAX.

By act No. 1455 the collection of the land tax for the calendar year 1906 was suspended throughout all the provinces and municipalities of the Philippine Islands, wherein operative, except in the city of Manila, and ₱2,690,890.69 was appropriated for the several provinces and municipalities in lieu thereof, this appropriation being based upon the land-tax collections for the fiscal year 1905, and being divisible between the various provinces and municipalities concerned, upon the basis of the actual collections therein, during that fiscal year.

By resolution of the Commission, of March 12, 1906, the suspension of this tax was held not to be applicable to the Moro Province, and the excess of ₱32,321.45, which thus arose in the appropriation, and which had reverted to the general funds in the treasury, was reappropriated by act No. 1475 for the benefit of the province of Cebu, it appearing that by reason of the suspension of the land tax in that province for the year 1905, outside of certain excepted portions, the allotment upon the basis of the collections for such year was not an equitable one and would not afford it sufficient revenues for its current expenses.

The amounts thus appropriated were made payable to the various provinces in twelve monthly installments, beginning with the month of January, 1906.

To and including June 30, 1906, there was paid to the provinces, under these acts, six installments, aggregating the following amounts:

Albay	₱83,059.91
Ambos Camarines	29,223.27
Antique	7,772.53
Bataan	8,894.22
Batangas	43,362.91
Bohol	7,604.96
Bulacan	72,862.85
Cagayan	32,785.93
Capiz	19,439.78
Cavite	43,133.69
Cebu	32,722.46
Ilocos Norte	15,965.27
Ilocos Sur	50,995.99
Iloilo	52,663.63
Isabela	9,172.46
Laguna	104,815.42
Leyte	44,984.37

Misamis	₱16,508.10
Nueva Ecija	31,948.88
Occidental Negros	57,869.23
Oriental Negros	18,759.64
Pampanga	104,131.53
Pangasinan	89,916.40
Rizal	50,109.78
Romblon	6,216.56
Samar	21,651.41
Sorsogon	49,878.31
Surigao	15,419.53
Tarlac	25,579.66
Tayabas	126,456.41
Union	33,378.12
Zambales	10,411.09
Total of six installments under act No. 1455	1,317,694.30
Total of six installments under act No. 1475	16,160.69
Grand total	1,333,854.99

THE PROVINCIAL GOVERNMENTS.

EXPLANATION OF PROVINCIAL STATEMENTS.

The statements which follow show in detail the financial condition and operations of each province during the fiscal year.

Funds which have come into the possession of the provinces and municipalities are grouped under three main divisions, viz: (1) Balance July 1, 1905, (2) revenues, and (3) miscellaneous receipts, the totals of each division being separately shown.

Within the division "Revenues" there has only been included moneys which regularly accrue to the provinces and municipalities as revenue by general law. This division therefore does not include payments made to them by the insular government in the form of outright aid and loans, nor on account of the appropriation made by the insular government in lieu of the suspended land tax.

Within the division "Miscellaneous Receipts" there has been shown moneys accruing from all sources other than revenue as defined in the preceding paragraph.

For funds which have gone out of the possession of the provinces and the amount remaining on hand there also appears three divisions, viz: (1) Expenditures, (2) miscellaneous credits, and (3) balance June 30, 1906.

Within the division "Expenditures" there is included only expenditures for provincial purposes by the provincial boards.

Payments to municipalities of the proportion of revenues accruing to them, exchanges of currency and all other items which are not provincial expenditures as defined in the preceding paragraph are shown under "Miscellaneous Credits."

It is believed that this method of segregation will be especially advantageous to the provincial administrative bureau, presenting in clear form and in manner capable of immediate reference and comparison the vital statistical factors of a province's financial condition and resources.

The following condensed summary of provincial accounts as thus segregated is of interest:

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balances on hand July 1, 1905	₱1,745,737.63	₱382,143.10	Pfs. 151,803.07	Pfs. 1,211.35
Revenues	2,558,965.90	4,315,699.62	22.80	501.56
Miscellaneous receipts:				
Exchanges of currency	354,967.76	3,965.43	334,141.90	4,673.82
Other items	1,444,573.56	757,484.76		
Total debits	6,104,244.85	5,459,292.91	485,967.77	6,386.73
CREDITS.				
Expenditures	3,712,977.83		474.20	
Miscellaneous credits:				
Payments to municipalities		4,954,022.90		1,224.52
Exchanges of currency	259,269.05	3,595.19	454,483.13	5,146.61
Other items	189,392.76	7,889.45	37.30	
Balances on hand June 30, 1906	1,942,605.21	493,785.37	30,973.14	15.60
Total credits	6,104,244.85	5,459,292.91	485,967.77	6,386.73

This summary is shown more in detail on pp. 295–297.

All revenues which accrue to the municipalities pass through the hands of the provincial treasurers. The total of the column "Municipal" in the division "Revenues" therefore represents all revenues which have accrued to the municipalities, and the item in the division "Miscellaneous Receipts" the receipts from all sources other than revenue.

Funds which accrue to the municipalities are by law required to be paid to them by the provincial treasurer within thirty days of their receipt by him. Such payments are shown under the heading "Municipal" and opposite "Miscellaneous credits—payments to municipalities." These funds thus pass out of provincial accounts.

As has been previously stated, the municipal fiscal year is coterminous with the calendar year, and the audit of the accounts of the municipalities was placed under the jurisdiction of this office by act No. 1482, passed May 1, 1906, to be effective from January 1, 1906. As it will be the practice to state the municipal accounts by their own fiscal year, no statement thereof appears in this report for the half of their fiscal year which had passed upon the termination of the insular and provincial fiscal year covered by this report. The report of municipal accounts for their fiscal year now existent will therefore appear in the annual report for the insular and provincial year 1907.

EXCHANGE OF CURRENCY.

Pursuant to the provisions of the act of Congress approved March 2, 1903, the purchase by provincial treasurers and their deputies throughout the municipalities of Mexican, Spanish-Filipino, and other currency formerly in circulation in the islands still continues under the following Executive order (No. 24, series 1905):

"In order to give every opportunity to the people of these islands to effect the exchange of the local currency in their possession for Philippine currency, it is hereby ordered that the insular treasurer and all provincial treasurers in the Philippine islands, shall, on and after this day and until further notice, purchase Spanish-Filipino currency, Mexican currency, Chinese subsidiary silver coins, and all foreign copper coins now circulating in the Philippine Islands at 1 peso Philippine currency for 1 peso and 30 centavos local currency."

The aggregate amount of currency thus exchanged is shown in the foregoing summary and in detail by provinces in the statements which follow. Its volume is now rapidly diminishing.

THE PROVINCE OF ABRA.

[Act No. 1306.]

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱3,912.52	₱2.79		
Revenues:				
Provincial portion of joint provincial-municipal—Land, road, and bridge	3.72			
Municipal portion of joint provincial-municipal—Land		10.66		
Total revenues	3.72	10.66		
Miscellaneous receipts:				
Payments to province—General provincial purpose, act No. 1306	14,497.13			
Total debits	18,413.37	13.45		
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	1,234.64			
Roads and bridges	2.50			
Contingent expenses	7,395.38			
Total expenditures	8,632.52			
Miscellaneous credits:				
Repayment of loans to insular government, acts Nos. 541 and 761	9,653.85			
Balance transferred to Ilocos Sur Province, act No. 1306	111.02	13.45		
Provincial portion of joint provincial-municipal revenue—Refund land tax, general	14.38			
Total miscellaneous credits	9,779.25	13.45		
Balance June 30, 1906	1.60			
Total credits	18,413.37	13.45		

By act No. 1306 the province of Abra was annexed to the province of Ilocos Sur as a subprovince, effective April 1, 1905, and its indebtedness assumed by the insular government, with the exception of the loan of ₱6,000 made by the insular government from Congressional relief funds for construction of public schools, which was assumed by the province of Ilocos Sur. The items appearing in the accounts of this province for the fiscal year 1906 arise from the settlement of its indebtedness and adjustment of the accounts of its former treasurers. Upon discontinuance of the province as a separate entity the treasurer of the province of Ilocos Sur becomes its treasurer ex officio for the closing up of its financial affairs.

THE PROVINCE OF ALBAY.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱140,353.19	₱23,759.68		
Revenues:				
Albay—				
All provincial—				
Registry of property	1,126.33			
Rental of provincial property	13.75			
Mining fees	46.00			
Miscellaneous	154.07			
Provincial portion of joint provincial-municipal—				
Industrial	104.06			
Cart	30.00			
Land, general	14,874.55			
Land, road and bridge	7,377.80			
Cedulas, act No. 1189	22,194.90			
Insular refund internal revenue, act No. 1189	24,925.41			
Municipal portion of joint provincial-municipal—				
Industrial		104.03		
Cedulas, act No. 83		152.00		
Cart		30.00		
Land		29,699.72		
Cedulas, act No. 1189		26,365.50		
Insular refund internal revenue, act No. 1189		32,303.37		
All municipal—				
Fisheries		7,351.45		
Ownership and transfer of cattle		3,796.50		
Rents, profits, and privileges		28,906.78		
Licenses		11,584.23		
Fines		5,081.53		
Licenses, act No. 1189		11,150.00		
Opium certificates, act No. 1461		970.00		
Non-Christian inhabitants—				
Insular refund internal revenue, act No. 1189	60.58			
Total revenues, Albay	70,907.45	157,495.11		
Subprovince of Catanduanes—				
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 83	334.60			
Land, general	1,138.12			
Land, road and bridge	628.37			
Cedulas, act No. 1189	4,170.60			
Insular refund internal revenue, act No. 1189	1,117.36			
Total revenues, subprovince of Catanduanes	7,389.05			
Miscellaneous receipts:				
Albay—				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	34,818.44	45,715.92		
School building fund, act No. 1275	43,000.00			
Exchanges of currency			Pfs. 3,215.70	
Loan to province, act No. 1418	35,000.00			
Repayments of loans by municipalities	2,000.00			
Total miscellaneous receipts, Albay	114,818.44	45,715.92	3,215.70	

THE PROVINCE OF ALBAY—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Miscellaneous receipts—Continued.				
Subprovince of Catanduanes—				
Payments to province—Insular appropriations in lieu of land tax, act No. 1455	₱2,525.55			
Appropriation for subprovince of Catanduanes	777.49			
Total miscellaneous receipts, subprovince of Catanduanes	3,303.04			
Total debits	336,771.17	₱226,970.71	Pfs. 3,215.70	
CREDITS.				
Expenditures:				
Albay—				
Provincial funds—				
Salaries	51,121.21			
Construction and repair of public buildings	2,045.62			
Roads and bridges	18,351.75			
Contingent expenses	49,997.82			
School building fund, act No. 1275	36,029.18			
Tabaco-Ligao road fund, act No. 1260	48,327.57			
Total expenditures, Albay	205,873.15			
Subprovince of Catanduanes—				
Provincial funds—				
Salaries	1,210.00			
Construction and repair of public buildings	102.25			
Contingent expenses	22.50			
Total expenditures, subprovince of Catanduanes	1,334.75			
Miscellaneous credits:				
Albay—				
Exchanges of currency	2,476.50			
Payments to municipalities		187,693.24		
Appropriation for subprovince of Catanduanes	777.49			
Joint provincial-municipal revenue—Refund industrial tax	182.60			
Congressional relief funds—Paid to province for construction of schools, act No. 1275	35,000.00			
Total miscellaneous credits, Albay	38,436.59	187,693.24		
Balance June 30, 1906:				
Albay	81,735.84	39,277.47	3,215.70	
Subprovince of Catanduanes	9,390.84			
Total credits	336,771.17	226,970.71	3,215.70	

THE PROVINCE OF AMBOS CAMARINES.

DEBITS.				
Balance July 1, 1905	₱20,784.57	₱13,300.12	Pfs. 453.83	
Revenues:				
All provincial—				
Registry of property	1,484.00			
Mining fees	68.00			
Miscellaneous	.78		.09	
Provincial portion of joint provincial-municipal—				
Industrial	147.22			
Cedulas, act No. 83	1,783.00			
Cart	224.38			
Land, general	14,968.53			

THE PROVINCE OF AMBOS CAMARINES—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Revenues—Continued.				
Provincial portion of joint provincial-municipal—Continued.				
Land, road and bridge	₱7,493.71			
Cedulas, act No. 1189	27,019.00			
Insular refund internal revenue, act No. 1189	21,433.28			
Daet franchise tax, act No. 1111	102.04			
Municipal portion of joint provincial-municipal—				
Industrial		₱147.20		
Cedulas, act No. 83		1,783.00		
Cart		224.37		
Land		28,818.32		
Cedulas, act No. 1189		27,019.00		
Insular refund internal revenue		31,836.99		
Daet franchise tax, act No. 1111		204.04		
All municipal—				
Fisheries		5,735.88		
Ownership and transfer of cattle		3,754.00		
Rents, profits, and privileges		18,150.19		
Licenses		7,518.26		
Fines		3,897.76		
Licenses, act No. 1189		6,961.00		
Sales of estray animals, act. No. 1147		178.61		
Opium certificates, act No. 1461		45.00		
Cemeteries		2.00		
Non-Christian inhabitants—Insular refund internal revenue, act No. 1189	402.91			
Total revenues	75,126.85	136,275.62	Pfs..09	
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	12,895.75	16,327.52		
School buildings fund, act No. 1275	8,000.00			
Exchange of currency	2,714.55		3,133.64	
Public contributions, construction of public wells	191.80			
Total miscellaneous receipts	23,802.10	16,327.52	3,133.64	
Total debits	119,713.52	165,903.26	3,587.56	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	41,533.20			
Construction and repair of public buildings	795.15			
Roads and bridges	9,260.44			
Contingent expenses	27,089.90			
Construction of public wells	191.80			
Congressional relief funds—				
Construction and repair of public buildings	2,793.09			
Roads and bridges	839.17			
Contingent expenses	500.00			
Total expenditures	83,002.75			
Miscellaneous credits:				
Exchanges of currency	2,427.77		3,498.26	
Payments to municipalities		152,289.06		
Total miscellaneous credits	2,427.77	152,289.06	3,498.26	
Balance June 30, 1906	34,283.00	13,614.20	89.30	
Total credits	119,713.52	165,903.26	3,587.56	

THE PROVINCE OF ANTIQUE.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱10,940.53	₱5,576.15	Pfs. 50.95	
Revenues:				
All provincial—Miscellaneous	3.57			
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 83	682.00			
Cart	167.79			
Land, general	4,367.44			
Land, road and bridge	2,183.64			
Cedulas, act No. 1189	12,224.00			
Insular refund internal revenue, act No. 1189	11,740.65			
Municipal portion of joint provincial-municipal—				
Cedulas, act No. 83		834.00		
Cart		167.76		
Land		8,734.66		
Cedulas, act No. 1189		12,224.00		
Insular refund internal revenue, act No. 1189		17,771.64		
All municipal—				
Fisheries		1,906.71		
Ownership and transfer of cattle		7,178.10		
Rents, profits, and privileges		3,504.64		
Licenses		235.17		
Fines		1,338.08		
Licenses, act No. 1189		516.00		
Opium certificates, act No. 1461		255.00		
Miscellaneous		5.00		
Non-Christian inhabitants—Insular refund, internal revenue, act No. 1189	296.08			
Total revenues	31,665.17	54,670.76		
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	3,398.50	4,374.03		
School building fund, act No. 1275	6,000.00			
Exchanges of currency	688.23		843.75	
Total miscellaneous receipts	10,086.73	4,374.03	843.75	
Total debits	52,692.43	64,620.94	894.70	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	18,942.34			
Construction and repair of public buildings	109.07			
Roads and bridges	3,505.57			
Contingent expenses	12,923.55			
School building fund, act No. 1275	10.00			
Congressional relief funds—				
Construction and repair of public buildings	896.54			
Roads and bridges	181.50			
Total expenditures	36,568.57			
Miscellaneous credits:				
Exchanges of currency	649.03		894.70	
Payments to municipalities		58,519.89		
Loans to municipalities	200.00			
Total miscellaneous credits	849.03	58,519.89	894.70	
Balance June 30, 1906	15,274.83	6,101.05		
Total credits	52,692.43	64,620.94	894.70	

THE PROVINCE OF BATAAN.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱8,392.68	₱4,317.54	Pfs. 1,419.47	
Revenues:				
All provincial—				
Registry of property	30.83			
Miscellaneous	536.48			
Provincial portion of joint provincial-municipal—				
Industrial	1.25			
Cedula, act No. 83	103.00			
Stamp	17.00			
Cart	362.51			
Land, general	4,408.40			
Land, road and bridge	2,204.07			
Cedula, act No. 1189	5,419.50			
Insular refund internal revenue, act No. 1189	2,967.28			
Municipal portion of joint provincial-municipal—				
Industrial		1.25		
Cedula, act No. 83		103.00		
Stamp		17.00		
Cart		362.49		
Land		7,302.42		
Cedula, act No. 1189		5,419.50		
Insular refund internal revenue, act No. 1189		6,136.12		
All municipal:				
Fisheries		2,674.07		
Ownership and transfer of cattle		3,246.00		
Rents, profits, and privileges		7,025.45		
Licenses		1,044.24		
Fines		1,615.37		
Licenses, act No. 1189		2,169.50		
Sales of estray animals, act No. 1147		10.00		
Cemeteries, act No. 1458		17.70		
Non-Christian inhabitant—Insular refund internal revenue, act No. 1189	164.54			
Total revenues	16,214.86	37,144.11		
Miscellaneous receipts:				
Payments to provinces—Insular appropriation in lieu of land tax, act No. 1455	4,667.91	4,226.31		
Loans to province, act No. 1410	6,000.00			
Public contributions school building funds	1,035.25			
Exchanges of currency	5,113.93		5,058.55	
Total miscellaneous receipts	16,817.09	4,226.31	5,058.55	
Total debits	41,424.63	45,687.96	6,478.02	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	14,358.92			
Construction and repair public buildings	695.35			
Roads and bridges	383.45			
Contingent expenses	4,923.11			
Congressional relief fund—				
Roads and bridges	45.25			
Contingent expenses	7.24			
Total expenditures	20,413.32			
Miscellaneous credits:				
Exchanges of currency	3,890.43		6,478.02	
Payments to municipalities		41,062.70		
Total miscellaneous credits	3,890.43	41,062.70	6,478.02	
Balance June 30, 1906	17,120.88	4,625.26		
Total credits	41,424.63	45,687.96	6,478.02	

THE PROVINCE OF BATANGAS.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July, 1905	₱35,747.02	₱7,248.15		
Revenues:				
All provincial—				
Registry of property	93.75			
Rental of provincial property	126.00			
Mining fees	32.75			
Provincial portion of joint provincial-municipal—				
Industrial	293.50			
Cedulas, act No. 83	2,064.00			
Cart	287.50			
Land, general	17,366.46			
Land, road, and bridge	8,684.97			
Cedulas, act No. 1189	32,598.50			
Insular refund internal revenue, act No. 1189	6,185.41			
Municipal portion of joint provincial-municipal—				
Industrial		293.50		
Cedulas, act No. 83		2,064.00		
Cart		287.50		
Land		26,046.21		
Cedulas, act No. 1189		32,598.50		
Insular refund internal revenue, act No. 1189		34,705.67		
All municipal—				
Fisheries		13,770.27		
Ownership and transfer of cattle		20,085.00		
Rents, profits, and privileges		18,505.00		
Licenses		16,716.03		
Fines		3,361.83		
Licenses, act No. 1189		4,107.50		
Sales of estray animals, act No. 1189		1,392.58		
Opium certificates, act No. 1461		185.00		
Total revenues	67,732.84	174,118.59		
Miscellaneous receipts:				
Payments to province—Insular appropriations in lieu of land tax, act No. 1455	22,288.59	21,074.32		
Repayment of loans by municipalities	7,021.50			
Sales of rice, Congressional relief	1,126.30			
Total miscellaneous receipts	30,436.39	21,074.32		
Total debits	133,916.25	202,441.06		
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	31,394.61			
Construction and repair of public buildings	1,229.67			
Roads and bridges	11,299.29			
Contingent expenses	24,955.47			
School-building fund, act No. 1275	15,987.00			
Congressional relief funds—roads and bridges	1,126.30			
Total expenditures	85,992.34			
Miscellaneous credits:				
Payments to municipalities		188,189.95		
Repayments of loans to insular government	11,635.53			
Total miscellaneous credits	11,635.53	188,189.95		
Balance June 30, 1906	36,288.38	14,251.11		
Total credits	133,916.25	202,441.06		

THE PROVINCE OF BENGUET.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱5,044.10	₱619.85		
Revenues:				
All provincial—				
Registry of property	26.00			
Mining fees	239.00			
Fees, justice of the peace, act No. 1396	71.40			
Road tax, act No. 1396	4,096.00			
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 1189	619.50			
Insular refund internal revenue, act No. 1189	2,041.99			
Municipal portion of joint provincial-municipal—				
Cedulas, act No. 1189		619.50		
Insular refund internal revenue, act No. 1189		762.01		
All municipal—				
Ownership and transfer of cattle		4,186.00		
Licenses, act No. 1189		7.50		
Township and settlement—insular refund internal revenue, act No. 1189	2,300.99			
Total revenues	9,394.88	5,575.01		
Miscellaneous receipts:				
Payments to provinces—				
School-building fund, act No. 1275	1,226.93			
General provincial purpose	19,999.15			
Return of insular deposits	392.70			
Total miscellaneous receipts	21,618.78			
Total debits	36,057.76	6,194.86		
CREDITS.				
Expenditures:				
Provincial fund—				
Salaries	12,985.74			
Construction and repair of public buildings	127.00			
Roads and bridges	4,787.20			
Contingent expenses	6,782.72			
School-building fund, act No. 1275	1,110.42			
Township and settlement fund	390.11			
Total expenditures	26,183.19			
Miscellaneous credits: Payments to municipalities		6,118.86		
Total miscellaneous credits		6,118.86		
Balance June 30, 1906	9,874.57	76.00		
Total credits	36,057.76	6,194.86		

THE PROVINCE OF BOHOL.

DEBITS.				
Balance July 1, 1905	₱9,153.86	₱14,974.52	Pfs. 30,346.27	
Revenues:				
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 83	1,029.00			
Cart	95.68			
Land, general	4,087.88			
Land, road, and bridge	15,200.44			
Cedulas act No. 1189	26,499.00			
Insular refund of internal revenue, act No. 1189	22,889.16			

THE PROVINCE OF BOHOL—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Revenues—Continued.				
Municipal portion of joint provincial-municipal—				
Cedulas, act No. 83		₱1,029.00		
Cart		95.67		
Land		25,729.36		
Cedulas, act No. 1189		26,499.00		
Insular refund of internal revenue, act No. 1189		36,255.40		
All municipal—				
Fisheries		4,933.59		
Ownership and transfer of cattle		9,808.00		
Rents, profits, and privileges		6,037.52		
Licenses		4,460.81		
Fines		867.52		
Licenses, act No. 1189		5,395.50		
Sale of estray animals, act No. 1147		4.00		
Total revenues	₱69,801.16	121,115.37		
Miscellaneous receipts:				
Payments to province—				
Insular appropriation in lieu of land tax, act No. 1455	3,259.29	4,345.67		
School-building fund, act No. 1275	12,000.00			
School assistance fund, act No. 797	6,000.00			
Loan to province—Congressional relief fund	18,383.71			
Sales of Congressional relief rice	209.79			
Exchanges of currency	48,376.44		Pfs. 32,374.46	
Total miscellaneous receipts	88,229.23	4,345.67	32,374.46	
Total debits	167,184.25	140,435.56	62,720.73	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	29,095.91			
Construction and repair of public buildings	1,156.04			
Roads and bridges	497.94			
Contingent expenses	11,539.03			
School-assistance fund, act No. 797	4,279.57			
Total expenditures	46,568.49			
Miscellaneous credits:				
Exchanges of currency	24,928.38		62,458.53	
Payments to municipalities		127,743.25		
Loans to municipalities	17,443.50			
Total miscellaneous credits	42,371.88	127,743.25	62,458.53	
Balance June 30, 1906	78,243.88	12,692.31	262.20	
Total credits	167,184.25	140,435.56	62,720.73	

THE PROVINCE OF BULACAN.

DEBITS.				
Balance July 1, 1905	₱66,496.37	₱6,099.80	Pfs. 208.44	
Revenues:				
All provincial—				
Registry of property	299.62			
Mining fees	14.00			
Provincial portion of joint provincial-municipal—				
Industrial	188.06			
Cedulas, act No. 83	974.00			
Cart	164.40			
Land, general	6,258.61			

THE PROVINCE OF BULACAN—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Revenues—Continued.				
Provincial portion of joint provincial-municipal—Continued.				
Land, road and bridge	₱3,128.99			
Cedulas, act No. 1189	29,287.00			
Insular refund internal revenue, act No. 1189	14,059.46			
Municipal portion of joint provincial-municipal—				
Industrial		₱188.06		
Cedulas, act No. 83		974.00		
Cart		164.40		
Land		10,296.57		
Cedulas, act No. 1189		29,287.00		
Insular refund internal revenue, act No. 1189		30,102.45		
All municipal—				
Fisheries		621.56		
Ownership and transfer of cattle		9,797.00		
Rents, profits, and privileges		42,387.98		
Licenses		8,949.36		
Fines		5,121.67		
Licenses, act No. 1189		4,447.50		
Sales of estray animals, act No. 1147		974.20		
Opium certificates, act No. 1461		165.00		
Non-Christian inhabitants—Insular refund internal revenue, act No. 1189	28.19			
Total revenues	54,402.33	143,476.75		
Miscellaneous receipts:				
Payments to province—.				
Insular appropriations in lieu of land tax, act No. 1455	34,742.75	38,120.10		
Roads and bridges, Congressional relief, act No. 1198	60.41			
School-building fund, act No. 1275	10,000.00			
Exchanges of currency	17,115.03		Pfs. 27,091.43	
Total miscellaneous receipts	61,918.19	38,120.10	27,091.43	
Total debits	182,816.89	187,696.65	27,299.87	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	48,668.18			
Construction and repair of public buildings	2,913.19			
Roads and bridges	14,230.38			
Contingent expenses	35,008.38		26.79	
School-building fund, act No. 1275	32,000.00			
Total expenditures	132,820.13		26.79	
Miscellaneous credits:				
Exchanges of currency	20,839.25		22,249.55	
Payments to municipalities		173,410.24		
Total miscellaneous credits	20,839.25	173,410.24	22,249.55	
Balance June 30, 1906	29,157.51	14,286.41	5,023.53	
Total credits	182,816.89	187,696.65	27,299.87	

THE PROVINCE OF CAGAYAN.

DEBITS.				
Balance July 1, 1905	₱14,751.34	₱5,122.08	Pfs. 26,478.97	
Revenues:				
All provincial—				
Registry of property	20.30			
Mining fees	2.00			
Miscellaneous	37.35			

THE PROVINCE OF CAGAYAN—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Revenues—Continued.				
Provincial portion of joint provincial-municipal—				
Industrial	₱128.50			
Cedulas, act No. 83	1,719.00			
Cart	908.18			
Land, general	11,038.51			
Land, road and bridge	11,040.57			
Cedulas, act No. 1189	19,550.50			
Insular refund internal-revenue, act No. 1189	10,401.23			
Municipal portion of joint provincial-municipal—				
Industrial		₱128.49		
Cedulas, act No. 83		1,719.00		
Cart		908.12		
Land		41,953.13		
Cedulas, act No. 1189		19,550.50		
Insular refund internal-revenue, act No. 1189		19,683.20		
All municipal—				
Fisheries		3,354.20		Pfs. 69.18
Ownership and transfer of cattle		19,310.15		14.56
Rents, profits, and privileges		14,128.85		246.68
Licenses		5,669.12		77.85
Fines		3,257.14		93.29
Licenses, act No. 1189		9,283.49		
Sales of estray animals, act No. 1147		756.75		
Miscellaneous		240.70		
Non-Christian inhabitants—insular refund internal revenue, act No. 1189	1,357.01			
Total revenues	56,203.15	139,942.84		501.56
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	11,355.17	21,430.76		
School building fund, act No. 1275	8,000.00			
Provincial building fund, act No. 1416	30,000.00			
Exchanges of currency	34,299.09		Pfs. 17,582.93	
Total miscellaneous receipts	83,654.26	21,430.76	17,582.93	
Total debits	154,608.75	166,495.68	44,061.90	501.56
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	32,563.31			
Construction and repair of public buildings	1,068.65			
Roads and bridges	10,285.27			
Contingent expenses	22,764.35			
Non-Christian inhabitant funds	6.20			
Total expenditures	66,687.78			
Miscellaneous credits:				
Exchanges of currency	14,298.15		42,298.52	
Payments to municipalities		154,439.23		501.56
Total miscellaneous credits	14,298.15	154,439.23	42,298.52	501.56
Balance June 30, 1906	73,622.82	12,056.45	1,763.38	
Total credits	154,608.75	166,495.68	44,061.90	501.56

THE PROVINCE OF CAPIZ.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱14,377.80	₱7,451.00	Pfs. 214.18	Pfs. 331.38
Revenues:				
All provincial—				
Registry of property	1.50			
Prison labor	5.30			
Miscellaneous	7.67			
Provincial portion of joint provincial-municipal—				
Industrial	7.25			
Cedulas, act No. 83	1,094.00			
Cart	68.50			
Land, general	10,338.59			
Land, road and bridge	5,169.25			
Cedulas, act No. 1189	20,900.50			
Insular refund internal revenue, act No. 1189	20,713.64			
Municipal portion of joint provincial-municipal—				
Industrial		7.25		
Cedulas, act No. 83		1,094.00		
Cart		68.50		
Land		20,677.10		
Cedulas, act No. 1189		20,900.50		
Insular refund internal revenue, act No. 1189		30,688.20		
All municipal—				
Fisheries		1,618.94		
Ownership and transfer of cattle		5,217.00		
Rents, profits, and privileges		10,375.27		
Licenses		2,518.55		
Fines		852.18		
Licenses, act No. 1189		1,277.00		
Sales of estray animals, act No. 1147		1,049.25		
Opium certificates, act No. 1461		260.00		
Non-Christian inhabitants—insular refund internal revenue, act No. 1189	382.26			
Total revenues	58,688.46	96,603.74		
Miscellaneous receipts:				
Payments to province—insular appropriations in lieu of land tax, act No. 1455	8,331.30	11,108.48		
Repayments of loans by municipalities	76.92			
Exchanges of currency	1,780.93	3,835.58	2,142.33	4,654.94
Sales of galvanized iron, congressional relief	88.00			
Total miscellaneous receipts	10,277.15	14,944.06	2,142.33	4,654.94
Total debits	83,343.41	118,998.80	2,356.51	4,986.32
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	26,361.82			
Construction and repair of public buildings	74.67			
Roads and bridges	6,752.65			
Contingent expenses	17,072.16			
Congressional relief funds—roads and bridges	197.00			
Total expenditures	50,458.30			
Miscellaneous credits:				
Exchanges of currency	1,647.92	3,580.67	2,315.21	4,986.32
Payments to municipalities		102,795.71		
Repayments of loan to insular government	15,000.00			
Payment to Romblon Province, erroneous refund of forestry	1.14	1.14		
Total miscellaneous credits	16,649.06	106,377.52	2,315.21	4,986.32
Balance June 30, 1906	16,236.05	12,621.28	41.30	
Total credits	83,343.41	118,998.80	2,356.51	4,986.32

THE PROVINCE OF CAVITE.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱56,956.49	₱3,966.98		
Revenues:				
All provincial—				
Registry of property	691.67			
Miscellaneous	.82			
Provincial portion of joint provincial municipal—				
Cedulas, act No. 83	49.00			
Cart	20.17			
Land, general	6,247.49			
Land, road and bridge	3,123.74			
Cedula, act No. 1189	17,249.00			
Insular refund internal revenue, act No. 1189	8,656.35			
Municipal portion of joint provincial-municipal—				
Cedulas, act No. 83		49.00		
Cart		20.15		
Land		12,494.76		
Cedula, act No. 1189		17,249.00		
Insular refund internal revenue, act No. 1189		18,150.26		
All municipal—				
Fisheries		1,720.88		
Ownership and transfer of cattle		4,212.00		
Rents, profits, and privileges		36,776.50		
Licenses		22,143.33		
Fines		8,290.03		
Licenses, act No. 1189		6,639.91		
Opium certificates, act No. 1461		370.00		
Sale of estray animals, act No. 1147		334.55		
Miscellaneous		28.83		
Total revenues	36,038.24	128,479.20		
Miscellaneous receipts:				
Payments to province—				
Congressional relief fund	20,000.00			
Insular appropriation in lieu of land tax, act No. 1455	18,352.00	24,781.69		
Sales Congressional relief rice	4,017.41			
Exchanges of currency	4,565.31		Pfs. 5,935.17	
Aid municipal schools, Congressional relief		13,877.68		
Total miscellaneous receipts	46,934.72	38,659.37	5,935.17	
Total debits	139,929.45	171,105.55	5,953.17	
CREDITS.				
Expenditures:				
Provincial fund—				
Salaries	30,452.37			
Construction and repair of public buildings	1,145.03			
Roads and bridges	10,829.59			
Contingent expenses	11,588.51			
Congressional reilef fund—				
Indang-Naic road, act No. 1327	16,140.82			
Construction and repair of public buildings	7,002.34			
Roads and bridges	22,678.53			
Contingent expenses	1,401.19			
Total expenditures	101,238.38			
Miscellaneous credits:				
Exchanges of currency	4,565.31		5,935.17	
Payments to municipalities		158,472.91		
Losses, section 41, act No. 1402	338.48			
Total miscellaneous credits	4,903.79	158,472.91	5,935.17	
Balance June 30, 1906	33,787.28	12,632.64		
Total credits	139,929.45	171,105.55	5,935.17	

THE PROVINCE OF CEBU.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱107,839.06	₱21,148.25		
Revenues:				
All provincial—				
Registry of property	291.93			
Mining fees	52.00			
Provincial portion of joint provincial-municipal—				
Industrial	223.77			
Cedulas, act No. 83	543.00			
Stamps	1.75			
Cart	259.92			
Land, general	9,370.79			
Land, road and bridge	4,686.18			
Cedulas, act No. 1189	55,100.00			
Insular refund internal revenue, act No. 1189	57,573.67			
Municipal portion of joint provincial-municipal—				
Industrial		223.74		
Cedulas, act No. 83		543.00		
Stamps		1.76		
Cart		259.96		
Land		18,751.34		
Cedulas, act No. 1189		55,100.00		
Insular refund internal revenue, act No. 1189		88,035.34		
All municipal—				
Fisheries		4,947.39		
Ownership and transfer of cattle		13,731.00		
Rents, profits, and privileges		27,838.46		
Licenses		20,765.58		
Fines		4,711.91		
Licenses, act No. 1189		15,739.00		
Sales of estray animals		3.00		
Opium certificates, act No. 1461		15.00		
Miscellaneous		302.50		
Total revenues	128,103.01	250,968.98		
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax—				
Act No. 1475	6,926.01	9,234.68		
Act No. 1455	14,022.74	18,699.72		
Loan to province, act No. 1380	25,000.00			
Repayment of loans by municipalities	8,114.38			
Sale of rice, Congressional relief	17.61			
Sales of galvanized iron, Congressional relief	25.84			
Exchanges of currency	24,910.83		Pfs. 32,384.12	
Total miscellaneous receipts	79,017.41	27,934.40	32,384.12	
Total debits	314,959.48	300,051.63	32,384.12	
CREDITS.				
Expenditures:				
Provincial funds—				
Construction and repair of public buildings	5,406.78			
Salaries	61,658.46			
Roads and bridges	21,741.20			
Contingent expenses	41,581.63			
Congressional relief funds—roads and bridges	149.69			
Total expenditures	130,537.76			
Miscellaneous credits:				
Exchanges of currency	24,910.84		32,384.12	
Payments to municipalities		267,706.32		
Loans to municipalities	19,830.00			
Losses, section 41, act No. 1402	451.50			
Total miscellaneous credits	45,192.34	267,706.32	32,384.12	
Balance June 30, 1906	139,229.38	32,345.31		
Total credits	314,959.48	300,051.63	32,384.12	

THE PROVINCE OF ILOCOS NORTE.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱25,161.45	₱8,393.08		
Revenues:				
All provincial—				
Registry of property	169.43			
Rental of provincial property	90.00			
Mining fees	62.00			
Prison labor	523.95			
Miscellaneous	8.38			
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 83	49.00			
Cart	607.62			
Land, general	7,126.82			
Land, road, and bridge	3,563.45			
Cedulas, act No. 1189	20,153.00			
Insular refund internal revenue, act No. 1189	8,533.79			
Municipal portion of joint provincial-municipal—				
Cedulas, act No. 83		49.00		
Cart		607.63		
Land		14,253.66		
Cedulas, act No. 1189		20,153.00		
Insular refund internal revenue, act No. 1189		23,707.50		
All municipal—				
Fisheries		1,513.71		
Ownership and transfer of cattle		17,944.00		
Rents, profits, and privileges		13,706.80		
Licenses		1,718.41		
Fines		1,356.99		
Licenses, act No. 1189		1,132.50		
Sales of estray animals, act No. 1147		215.06		
Opium certificates, act No. 1461		140.00		
Miscellaneous		187.10		
Non-Christian inhabitants—				
Ownership and transfer of cattle	166.00			
Insular refund internal revenue, act No. 1189	397.20			
Total revenues	41,450.64	96,685.36		
Miscellaneous receipts:				
Payments to province—insular appropriations in lieu of land tax, act No. 1455	6,842.27	9,123.00		
Public contributions school buildings fund	621.13			
Repayment of loans by municipalities	544.05			
Sales of rice, Congressional relief	5.00			
Total miscellaneous receipts	8,012.45	9,123.00		
Total debits	74,624.54	114,201.44		
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	30,518.91			
Construction and repair of public building	178.86			
Roads and bridges	1,942.93			
Contingent expenses	9,769.26			
Congressional relief funds—				
Construction and repair of public buildings	1,990.37			
Roads and bridges	2,700.88			
Barrio school buildings	7,730.53			
Non-Christian inhabitants' funds	38.00			
Total expenditures	54,869.74			
Miscellaneous credits: Payments to municipalities		105,419.30		
Total miscellaneous credits		105,419.30		
Balance June 30, 1906	19,754.80	8,782.14		
Total credits	74,624.54	114,201.44		

THE PROVINCE OF ILOCOS SUR.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱21,188.56	₱10,808.93	Pfs.173.98	Pfs.5.05
Revenues:				
All provincial—				
Registry of property	2,780.57			
Rental of provincial property	117.00			
Miscellaneous			20.35	
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 83	599.00			
Cart	7,782.41			
Land, general	18,458.48			
Land, road and bridge	9,232.77			
Cedulas, act No. 1189	28,825.00			
Insular refund internal revenue, act No. 1189	15,458.40			
Municipal portion of joint provincial-municipal—				
Cedulas, act No. 83		599.00		
Cart		7,782.49		
Land		36,874.79		
Cedulas, act No. 1189		28,647.00		
Insular refund internal revenue, act No. 1189		29,286.96		
All municipal—				
Fisheries		4,140.14		
Ownership and transfer of cattle		24,746.00		
Rents, profits, and privileges		25,262.18		
Licenses		3,551.78		
Fines		6,913.86		
Licenses, act No. 1189		5,481.00		
Sales of estray animals, act No. 1147		264.25		
Opium certificates, act No. 1461		150.00		
Personal tax, act No. 387		51.00		
Non-Christian inhabitants—				
Cedulas, act No. 1189	178.00			
Insular refund internal revenue, act No. 1189	2,934.92			
Total revenues	86,366.55	173,750.45	20.35	
Miscellaneous receipts:				
Payments to province—.				
Insular appropriations in lieu of land tax, act No. 1455	22,004.70	28,991.29		
School buildings fund, act No. 1275	17,000.00			
Aid to municipality of Santa, act No. 1406	5,000.00			
Loan to province—Congressional relief funds, acts Nos. 1076 and 1306	6,000.00			
Amount unapportioned internal-revenue refunds, act No. 1426	1,731.52			
Exchanges of currency	24,085.21		32,880.81	
Balance transferred from Abra Province, act No. 1306	111.02	13.45		
Total miscellaneous receipts	75,932.45	29,004.74	32,880.81	
Total debits	183,487.56	213,564.12	33,075.14	5.05
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	38,682.03			
Construction and repair of public buildings	4,884.85			
Roads and bridges	13,539.98			
Contingent expenses	28,042.53			
School buildings fund, act No. 1275	5,165.45			
Congressional relief funds—				
Construction and repair of public buildings	2,244.66			
Roads and bridges	3,230.87			
Total expenditures	95,790.37			
Miscellaneous credits:				
Exchanges of currency	25,291.75		31,310.80	
Payments to municipalities		199,725.28		

THE PROVINCE OF ILOCOS SUR—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
CREDITS—continued.				
Miscellaneous credits—Continued.				
Repayment of loans to insular government, act No. 1076	₱6,666.67			
Loans to municipalities	6,000.00			
Amount unapportioned internal revenue, act No. 1426		₱1,731.52		
Joint provincial-municipal revenue—refund industrial tax	56.47	56.47		
Total miscellaneous credits	38,014.89	201,513.27	Pfs. 31,310.80	
Balance June 30, 1906	49,682.30	12,050.85	1,764.34	Pfs. 5.05
Total credits	183,487.56	213,564.12	33,075.14	5.05

THE PROVINCE OF ILOILO.

DEBITS.				
Balance July 1, 1905	₱74,150.64	₱11,761.31	Pfs.9,511.35	Pfs.842.63
Revenues:				
All provincial—				
Registry of property	1,113.09			
Miscellaneous	35.80			
Provincial portion of joint provincial-municipal—				
Industrial	69.00			
Cedulas, act No. 83	748.00			
Cart	169.05			
Land, general	24,147.30			
Land, road and bridge	12,233.57			
Cedulas, act No. 1189	47,871.50			
Insular refund internal revenue, act No. 1189	37,873.41			
Municipal portion of joint provincial-municipal—				
Industrial		69.00		
Cedulas, act No. 83		748.00		
Cart		169.05		
Land		38,384.76		
Cedulas, act No. 1189		47,871.50		
Insular refund internal revenue, act No. 1189		54,822.34		
All municipal—				
Fisheries		5,064.98		
Ownership and transfer of cattle		13,452.78		
Rents, profits, and privileges		61,413.61		
Licenses		27,765.84		
Fines		10,080.28		
Licenses, act No. 1189		10,212.00		
Sales of estray animals, act No. 1147		5,344.95		
Opium certificates, act No. 1461		945.00		
Non-Christian inhabitants—insular refund internal revenue, act No. 1189.	433.47			
Total revenues	124,694.19	276,344.09		
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	27,194.20	25,469.43		
School buildings fund, act No. 1275	32,000.00			
Public contributions school buildings fund	21,086.70			
Repayment of loans by municipalities.	750.00			
Sales of rice, Congressional relief	16.80			
Exchanges of currency	7,707.45	87.44	3,390.81	
Total miscellaneous receipts	88,755.15	25,556.87	3,390.81	
Total debits	287,599.98	313,662.27	12,902.16	842.63

THE PROVINCE OF ILOILO—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	₱55,057.71		Pfs. 376.41	
Construction and repair of public buildings	14,439.41			
Roads and bridges	36,532.82			
Contingent expenses	58,351.21			
School buildings fund, act No. 1275	8,223.20			
Congressional relief funds—roads and bridges	232.76			
Total expenditures	172,837.11		376.41	
Miscellaneous credits:				
Exchanges of currency	2,608.29		9,894.51	Pfs. 113.58
Payments to municipalities		₱301,403.66		722.96
Total miscellaneous credits	2,608.29	301,403.66	9,894.51	836.54
Balance June 30, 1906	112,154.58	12,258.61	2,631.24	6.09
Total credits	287,599.98	313,662.27	12,902.16	842.63

THE PROVINCE OF ISABELA.

DEBITS.				
Balance July 1, 1905	₱447.90	₱2,671.50	Pfs. 7,894.58	
Revenues:				
All provincial—				
Registry of property	3.50			
Medical certificates, act No. 310	10.00			
Provincial portion of joint provincial-municipal—				
Industrial	11.72			
Cedulas, act No. 83	160.00			
Land, general	12,859.70			
Land, road and bridge	6,444.75			
Cedulas, act No. 1189	11,704.50			
Insular refund internal revenue, act No. 1189	4,533.78			
Municipal portion of joint provincial-municipal—				
Industrial		11.72		
Cedulas, act No. 83		160.00		
Land		25,808.77		
Cedulas, act No. 1189		11,704.50		
Insular refund internal revenue, act No. 1189		9,402.95		
All municipal—				
Fisheries		87.00		
Ownership and transfer of cattle		10,812.00		
Rents, profits, and privileges		3,075.77		
Licenses		1,849.15		
Fines		1,208.55		
Licenses, act No. 1189		4,917.50		
Sales of estray animals, act No. 1147		467.60		
Opium certificates, act No. 1461		460.00		
Non-Christian inhabitants—insular refund internal revenue, act No. 1189	889.78			
Total revenues	36,617.73	69,965.51		
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	3,932.34	5,240.12		
School-building fund, act No. 1275	10,000.00			
Public contributions school-building fund	3,876.26			
Exchanges of currency	11,414.41		9,832.24	
Total miscellaneous receipts	29,223.01	5,240.12	9,832.24	
Total debits	66,288.64	77,877.13	17,726.82	

THE PROVINCE OF ISABELA—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	₱21,353.10			
Roads and bridges	1,118.87			
Contingent expenses	8,136.51			
Non-Christian inhabitants funds	49.20			
Total expenditures	30,657.68			
Miscellaneous credits:				
Exchanges of currency	7,563.19		Pfs. 14,081.34	
Payments to municipalities		₱74,300.70		
Total miscellaneous credits	7,563.19	74,300.70	14,081.34	
Balance June 30, 1906	28,067.77	3,576.43	3,645.48	
Total credits	66,288.64	77,877.13	17,726.82	

THE PROVINCE OF LAGUNA.

DEBITS.				
Balance July 1, 1905	₱75,067.27	₱9,927.75	Pfs. 8,564.60	
Revenues:				
All provincial—				
Registry of property	409.84			
Rental of provincial property	50.00			
Mining fees	32.00			
Miscellaneous	4.51		.61	
Provincial portion of joint provincial-municipal—				
Industrial	34.24			
Cedulas, act No. 83	919.00			
Cart	359.30			
Land, general	25,098.93			
Land, road, and bridge	12,549.77			
Cedulas, act No. 1189	20,684.00			
Insular refund internal revenue, act No. 1189	6,613.73			
Municipal portion of joint provincial-municipal—				
Industrial		34.25		
Cedulas, act No. 83		919.00		
Cart		359.30		
Land		50,198.21		
Cedulas, act No. 1189		20,684.00		
Insular refund internal revenue, act No. 1189		20,012.29		
All municipal—				
Fisheries		550.40		
Ownership and transfer of cattle		5,297.98		
Rents, profits, and privileges		37,111.93		
Licenses		6,424.21		
Fines		4,730.29		
Licenses, act No. 1189		4,917.50		
Sales of estray animals, act No. 1147		274.50		
Opium certificates, act No. 1461		160.00		
Cemeteries		53.25		
Miscellaneous		1,266.89		
Total revenues	66,755.32	152,994.00	.61	
Miscellaneous receipts:				
Payments to province—insular appropriations in lieu of land tax, act No. 1455	44,920.87	59,894.55		
Sales of rice, Congressional relief	44.75			
Exchanges of currency	18,548.78		17,119.75	
Total miscellaneous receipts	63,514.40	59,894.55	17,119.75	
Total debits	205,336.99	222,816.30	25,684.96	

THE PROVINCE OF LAGUNA—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	₱46,133.89			
Construction and repair of public building	440.90			
Roads and bridges	22,536.41			
Contingent expenses	23,963.09			
Congressional relief funds—Contingent expenses	256.66			
Total expenditures	93,330.95			
Miscellaneous credits:				
Exchange of currency	13,164.31		Pfs. 23,928.20	
Payments to municipalities		₱207,655.55		
Losses, section 41, act No. 1402	594.14			
Total miscellaneous credits	13,758.45	207,655.55	23,928.20	
Balance June 30, 1906	98,247.59	15,160.75	1,756.76	
Total credits	205,336.99	222,816.30	25,684.96	

THE PROVINCE OF LEPANTO-BONTOC.

DEBITS.				
Balance July 1, 1905	₱5,058.00	₱4,380.12	Pfs. 119.70	
Revenues:				
All provincial—				
Registry of property	76.00			
Rental of provincial property	50.00			
Mining fees	106.00			
Fees justice of peace, act No. 1396	25.00			
Road tax, act No. 1396	7,574.00			
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 1189	6,727.50			
Insular refund internal revenue, act No. 1189	6,262.27			
Municipal portion of joint provincial-municipal—				
Cedulas, act No. 1189		6,727.50		
Insular refund internal revenue, act No. 1189		2,437.30		
All municipal—				
Fisheries		123.75		
Ownership and transfer of cattle		3,445.06		
Rents, profits, and privileges		665.82		
Licenses		334.81		
Fines		264.59		
Licenses, act No. 1189		400.00		
Opium certificates, act No. 1461		10.00		
Property tax		3,516.20		
Cedulas, act No. 387		7.00		
Township and settlement—insular refund internal revenue, act No. 1189	7,359.72			
Total revenues	28,180.49	17,932.03		
Miscellaneous receipts:				
Payments to province—general provincial purposes, act No. 1416	29,250.00			
Exchanges of currency	2,761.13		4,402.27	
Amount unapportioned internal revenue refunds, act No. 1426	5,714.52			
Total miscellaneous receipts	37,725.65		4,402.27	
Total debits	70,964.14	22,312.15	4,521.97	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	25,556.56			
Construction and repair of public buildings	3,239.57			
Roads and bridges	8,060.72			
Contingent expenses	10,650.88			
Total expenditures	47,507.73			

THE PROVINCE OF LEPANTO-BONTOC—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
CREDITS—continued.				
Miscellaneous credits:				
Exchanges of currency	₱3,386.29		Pfs. 3,589.47	
Payments to municipalities		₱15,419.74		
Amount unapportioned internal revenue refunds, act No. 1426		5,714.52		
Total miscellaneous credits	3,386.29	21,134.26	3,589.47	
Balance June 30, 1906	20,070.12	1,177.89	932.50	
Total credits	70,964.14	22,312.15	4,521.97	

THE PROVINCE OF LEYTE.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱20,663.48	₱19,882.27		
Revenues:				
All provincial—				
Registry of property	198.63			
Prison labor	3,879.71			
Fares, provincial launch	285.50			
Provincial portion of joint provincial-municipal—				
Cedula, act No. 83	1.00			
Cart	421.75			
Land, general	7,299.19			
Land, road and bridge	3,650.48			
Cedulas, act No. 1189	58,987.50			
Insular refund internal revenue, act No. 1189	25,006.66			
Municipal portion of joint provincial-municipal—				
Cedula, act No. 83		1.00		
Cart		421.75		
Land		14,599.09		
Cedulas, act No. 1189		58,987.50		
Insular refund internal revenue, act No. 1189		52,374.90		
All municipal—				
Fisheries		8,622.41		
Ownership and transfer of cattle		8,158.00		
Rents, profits and privileges		18,844.99		
Licenses		20,647.32		
Fines		5,867.69		
Licenses, act No. 1189		13,071.50		
Miscellaneous		1,474.50		
Opium certificates, act No. 1461		1,510.00		
Total revenues	99,730.42	204,580.65		
Miscellaneous receipts:				
Payments, to province — Insular appropriations in lieu of land tax, act No. 1455	19,268.34	25,716.03		
Exchanges of currency	3,626.35		Pfs. 5,436.04	
Total miscellaneous receipts	22,894.69	25,716.03	5,436.04	
Total debits	143,288.59	250,178.95	5,436.04	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	56,512.74			
Construction and repair of public buildings	3,958.05			
Roads and bridges	4,814.63			
Contingent expenses	30,657.89			
Maintenance municipal police, act No. 781	136.00			
Construction of wharf	1,764.55			
Total expenditures	97,843.86			

PROVINCE OF LEYTE—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
CREDITS—continued.				
Miscellaneous credits:				
Exchanges of currency	₱ 4,203.60		Pfs. 4,655.64	
Payments to municipalities		₱ 228,074.96		
Total miscellaneous credits	4,203.60	228,074.96	4,655.64	
Balance June 30, 1906	41,241.13	22,103.99	780.40	
Total credits	143,288.59	250,178.95	5,436.04	

THE PROVINCE OF MASBATE.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱7,203.57	₱833.66		
Revenues:				
All provincial—				
Registry of property	19.50			
Mining fees	90.00			
Miscellaneous	.01			
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 83	29.00			
Land, general	464.48			
Land, road and bridge	464.37			
Cedulas, act No. 1189	491.00			
Insular refund internal revenue, act No. 1189	975.48			
Municipal portion of joint provincial-municipal—				
Cedulas, act No. 83		27.00		
Land		1,857.38		
Cedulas, act No. 1189		491.00		
Insular refund internal revenue, act No. 1189		1,463.22		
All municipal—				
Fisheries		774.38		
Ownership and transfer of cattle		2,848.00		
Rents, profits, and privileges		254.56		
Licenses		324.05		
Fines		236.50		
Licenses, act No. 1189		105.00		
Total revenues	2,533.84	8,381.09		
Miscellaneous receipts:				
Payment to province—For purpose of repayment of loans, act No. 1413	5,000.00			
Exchanges of currency			Pfs. 1,125.25	
Total miscellaneous receipts	5,000.00		1,125.25	
Total debits	14,737.41	9,214.75	1,125.25	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	4,104.09			
Construction and repair of public buildings	21.34			
Contingent expenses	460.02			
Congressional relief fund—Construction and repair of public buildings	2,878.66			
Total expenditures	7,464.11			
Miscellaneous credits:				
Exchanges of currency	865.55			
Payments to municipalities		8,066.02		
Repayment of loan to insular government, act No. 134	5,000.00			
Transferred to Sorsogon Province Dec. 31, 1905, act No. 1413	1,407.75	1,148.73	1,125.25	
Total miscellaneous credits	7,273.30	9,214.75	1,125.25	
Total credits	14,737.41	9,214.75	1,125.25	

January 1, 1906, the province of Masbate was combined with the province of Sorsogon under the provisions of act No. 1413.

THE PROVINCE OF MINDORO.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱6,564.04	₱7,602.60		
Revenues:				
All provincial—				
Registry of property	17.00			
Mining fees	34.00			
Fares, provincial launch	346.93			
Fees, justice of the peace, act No. 1396	222.50			
Fees, provincial sheriff, act No. 176	69.20			
Road tax, act 1396	15,320.00			
Provincial portion of joint provincial-municipal—				
Cart	5.50			
Cedulas, act No. 1189	5,156.50			
Insular refund internal revenue, act No. 1189	3,547.59			
Municipal portion of joint provincial-municipal—				
Cart		5.50		
Cedulas, act No. 1189		5,156.50		
Insular refund internal revenue, act No. 1189		2,642.39		
All municipal—				
Fisheries		2,390.75		
Ownership and transfer of cattle		10,505.00		
Rents, profits, and privileges		2,322.03		
Licenses		1,717.11		
Fines		3,560.90		
Licenses, act No. 1189		955.00		
Opium certificates, act No. 1461		45.00		
Cedulas, act No. 387		522.00		
Cart, act 387		9.00		
Property tax		7,184.32		
Township and settlement—Insular refund internal revenue, act No. 1189	2,687.98			
Total revenues	27,407.20	37,015.50		
Miscellaneous receipts:				
Payments to province—				
School-buildings fund, act No. 1275	4,998.68			
Construction of piers fund, act No. 1406	6,000.00			
General provincial purpose, act No. 1416	41,700.00			
Payment of loans by municipalities	1,000.00			
Total miscellaneous receipts	53,698.68			
Total debits	87,669.92	44,618.10		
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	26,030.37			
Roads and bridges	2,000.00			
Contingent expenses	16,126.32			
School-building funds, act No. 1275	4,998.68			
Construction of piers fund, act No. 1406	5,502.74			
Congressional relief funds—Construction and repair of public buildings	3,255.70			
Total expenditures	57,913.81			
Miscellaneous credits:				
Payments to municipalities		44,456.35		
All provincial—Deposit in insular treasury amount erroneously certified as miscellaneous provincial revenue	3,461.60			
Total miscellaneous credits	3,461.60	44,456.35		
Balance June 30, 1906	26,294.51	161.75		
Total credits	87,669.92	44,618.10		

THE PROVINCE OF MISAMIS.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱25,117.48	₱10,751.71		
Revenues:				
All provincial—				
Registry of property	38.00			
Mining fees	4.00			
Miscellaneous	10.00			
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 83	190.50		Pfs. 1.12	
Cart	320.20			
Land, general	8,274.39			
Land, road and bridge	4,137.25			
Cedulas, act No. 1189	16,391.00			
Insular refund internal revenue, act No. 1189	5,798.62			
Municipal portion of joint provincial-municipal—				
Cedulas, act No. 83		186.50		
Cart		320.20		
Land		16,548.79		
Cedulas, act No. 1189		16,391.00		
Insular refund internal revenue, act No. 1189		19,896.45		
All municipal—				
Fisheries		1,190.71		
Ownership and transfer of cattle		5,481.00		
Rents, profits, and privileges		7,906.37		
Licenses		7,232.57		
Fines		3,494.44		
Licenses, act No. 1189		5,970.00		
Sales of estray animals, act No. 1147		103.37		
Opium certificates, act No. 1461		630.00		
Miscellaneous		167.50		
Non-Christian inhabitants—Insular refund internal revenue, act No. 1189	2,103.05			
Total revenues	37,267.01	85,518.90	1.12	
Miscellaneous receipts:				
Payments to province—Insular appropriations in lieu of land tax, act No. 1455	7,075.82	9,432.28		
Public contributions school-building fund	270.00			
Sales of rice, Congressional relief	1,632.98			
Sales of galvanized iron, Congressional relief	200.00			
Exchanges of currency	315.30		6,838.98	
Total miscellaneous receipts	9,494.10	9,432.28	6,838.98	
Total debits	71,878.59	105,702.89	6,840.10	
CREDITS.				
Balance July 1, 1905			6,430.38	
Expenditures:				
Provincial funds—				
Salaries	23,834.65			
Construction and repair of public buildings	416.45			
Roads and bridges	5,222.80			
Contingent expenses	12,839.14			
School-building fund, act No. 1275	63.00			
Congressional relief funds—				
Roads and bridges	996.32			
Contingent expenses	313.75			
Total expenditures	43,686.11			
Miscellaneous credits:				
Exchanges of currency	5,802.36		409.72	
Payments to municipalities		96,095.32		
Total miscellaneous credits	5,802.36	96,095.32	409.72	
Balance June 30, 1906	22,390.12	9,607.57		
Total credits	71,878.59	105,702.89	6,840.10	

THE PROVINCE OF MORO AND THE FIVE DISTRICTS.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱413,689.91	₱1,093.40	Pfs.761.33	
Revenues:				
All provincial—				
Registry of property	293.75			
Rental of provincial property	188.00			
Sales products trade school	470.90			
Cedulas	20,369.69			
Land, court fees	7.17			
Land	46,936.69			
Moro exchange	2,908.34			
Fines	1,802.00			
Shell-fishing licenses	3,375.00			
Arms permits	1,309.00			
Sales Chinese tobacco	1,395.20			
Sales products San Ramon farm	4,627.70			
Arrastre plant, Jolo act, No. 1432	2,060.21			
Insular refund internal revenue, act No. 1189	80,056.45			
Cedulas, act No. 1189	26,596.00			
Customs revenue	324,089.46			
All municipal—				
Ownership and transfer of cattle		8,334.00		
Rents, profits, and privileges		15,317.73		
License		51,382.29		
Fines		23,689.75		
Licenses, act No. 1189		3,532.50		
Opium certificates, act No. 1461		2,025.00		
Miscellaneous		2,061.59		
Total revenues	516,485.56	106,342.86		
Miscellaneous receipts:				
Forestry refunds due municipalities erroneously charged provincial		2,419.25		
Exchanges of currency	7,231.25		8,608.88	
Total miscellaneous receipts	7,231.25	2,419.25	8,608.88	
Total debits	937,406.72	109,855.51	9,370.21	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries, provincial official and employees	166,263.20			
Salaries, educational	95,843.13			
Construction and repair of public buildings	77,905.63			
Roads and bridges	64,114.59			
Contingent expenses	184,081.19			
Jolo wharf	23,856.57			
Zamboanga wharf	5,313.97			
Congressional relief funds—roads and bridges	175,639.61			
Total expenditures	793,017.89			
Miscellaneous credits:				
Exchanges of currency	6,699.11		9,343.01	
Forestry refunds due municipalities erroneously charged provincial	2,419.25			
Payments to municipalities		108,076.81		
Total miscellaneous credits	9,118.36	108,076.81	9,343.01	
Balance June 30, 1906	135,270.47	1,778.70	27.20	
Total credits	937,406.72	109,855.51	9,370.21	

THE PROVINCE OF NUEVA ECIJA.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱25,330.42	₱3,618.27		
Revenues:				
All provincial—				
Registry of property	304.60			
Mining fees	16.00			
Sales of estray animals, act No. 877.	1,763.00			
Miscellaneous	6.10			
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 83	23.00			
Cart	1,724.71			
Land, general	8,463.52			
Land, road, and bridge	4,232.16			
Cedulas, act No. 1189	16,573.00			
Insular refund internal revenue, act No. 1189	7,751.26			
Municipal portion of joint provincial-municipal—				
Cedulas, act No. 83		23.00		
Cart		1,724.69		
Land		12,658.76		
Cedulas, act No. 1189		16,573.00		
Insular refund internal revenue, act No. 1189		17,949.01		
All municipal—				
Fisheries		5,275.03		
Ownership and transfer of cattle		3,758.00		
Rents, profits, and privileges		10,129.14		
Licenses		4,029.66		
Fines		2,579.90		
Licenses, act No. 1189		3,226.50		
Sales of estray animals, act No. 1147		2,839.00		
Opium certificates, act No. 1461		160.00		
Cemeteries		47.50		
Non-Christian inhabitants—insular refund internal revenue, act No. 1189.	116.14			
Total revenues	40,973.49	80,973.19		
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	15,874.98	16,073.90		
School buildings fund, act No. 1275.	8,000.00			
Public contributions school buildings fund	2,000.00			
Exchanges of currency	1,411.84		Pfs. 1,835.40	
Total miscellaneous receipts	27,286.82	16,073.90	1,835.40	
Total debits	93,590.73	100,665.36	1,835.40	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	24,134.63			
Construction and repair of public buildings	1,570.83			
Roads and bridges	10,026.72			
Contingent expenses	23,221.15			
School buildings fund, act No. 1275	2,019.76			
Congressional relief funds:				
Salaries	25.00			
Construction and repair of public buildings	1,164.60			
Roads and bridges	43.58			
Contingent expenses	99.43			
Total expenditures	62,305.70			
Miscellaneous credits:				
Exchanges of currency	1,411.84		1,835.40	
Payments to municipalities		93,202.02		
Total miscellaneous credits	1,411.84	93,202.02	1,835.40	
Balance June 30, 1906	29,873.19	7,463.34		
Total credits	93,590.73	100,665.36	1,835.40	

THE PROVINCE OF NUEVA VIZCAYA.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱6,036.32	₱4,044.67	Pfs. 51.91	
Revenues:				
All provincial—				
Road tax, act No. 1396	7,416.00			
Fees, justice of the peace	56.00			
Provincial portion of joint provincial-municipal—				
Cart, act No. 1396	124.75			
Cedulas, act No. 1189	2,700.00			
Insular refund internal revenue, act No. 1189	5,614.79			
Municipal portion of joint provincial-municipal—				
Cart, act No. 1396		124.75		
Cedulas, act No. 1189		2,700.00		
Insular refund internal revenue, act No. 1189		865.35		
All municipal—				
Fisheries		.51		
Ownership and transfer of cattle		1,220.00		
Rents, profits, and privileges		1,109.54		
Licenses		635.33		
Fines		181.90		
Licenses, act No. 1189		236.00		
Cedulas, act No. 387		16.00		
Cart, act No. 387		596.75		
Property tax, act No. 387		1,466.89		
Township and settlement—insular refund internal revenue, act No. 1189.	7,556.87			
Total revenues	23,468.41	9,153.02		
Miscellaneous receipts:				
Payments to province—				
School buildings fund, act No. 1275.	500.00			
Padre Juan Villaverde trail, act No. 920	3,910.31			
General provincial purpose	17,500.00			
Exchanges of currency	357.85		413.30	
Total miscellaneous receipts	22,268.16		413.30	
Total debits	51,772.89	13,197.69	465.21	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	13,611.75			
Construction and repair of public buildings	3,036.30			
Roads and bridges	9,287.35			
Contingent expenses	7,663.35			
School buildings fund, act No. 1275	391.45			
Provincial government building fund, act No. 831	5,848.50			
Township and settlement fund	425.00			
Total expenditures	40,263.70			
Miscellaneous credits:				
Exchanges of currency	317.90		465.21	
Payments to municipalities		10,237.33		
Total miscellaneous credits	317.90	10,237.33	465.21	
Balance June 30, 1906	11,191.29	2,960.36		
Total credits	51,772.89	13,197.69	465.21	

THE PROVINCE OF OCCIDENTAL NEGROS.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱59,898.57	₱21,772.95	Pfs. 563.73	
Revenues:				
All provincial—				
Registry of property	2,151.72			
Prison labor	123.50			
Sales of estray animals, act No. 877.	444.00			
Mining fees	4.00			
Miscellaneous	97.00			
Provincial portion of joint provincial-municipal—				
Industrial	21.72			
Cedulas, act No. 83	382.16			
Cart	1,777.22			
Land, general	20,037.83			
Land, road, and bridge	10,018.91			
Cedulas, act No. 1189	41,232.00			
Insular refund internal revenue, act No. 1189	27,651.01			
Municipal portion of joint provincial-municipal—				
Industrial		21.70		
Cedulas, act No. 83		36.00		
Cart		1,777.07		
Land		37,539.37		
Cedulas, act No. 1189		41,232.00		
Insular refund internal revenue, act No. 1189		41,047.47		
All municipal—				
Fisheries		4,319.14		
Ownership and transfer of cattle		18,754.00		
Rents, profits, and privileges		20,950.84		
Licenses		4,126.06		
Fines		3,513.40		
Licenses, act No. 1189		8,091.00		
Opium certificates, act No. 1461		455.00		
Non-Christian inhabitants—Insular refund internal revenue, act No. 1189.	466.56			
Total revenues	104,407.63	181,863.05		
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	26,005.15	31,864.08		
School buildings fund, act No. 1275.	8,000.00			
Public contributions school buildings fund	6,394.35			
Repayments of loans by municipalities	541.66			
Sales of rice, Congressional relief	1,037.50			
Exchanges of currency	2,454.33		4,040.93	
Total miscellaneous receipts	44,432.99	31,864.08	4,040.93	
Total debits	208,739.19	235,500.08	4,604.66	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	41,591.22			
Construction and repair of public buildings	255.52			
Roads and bridges	11,417.93			
Contingent expences	43,840.61		7.00	
School buildings fund, act No. 1275	50.00			
Congressional relief funds—				
Salaries	22.00			
Construction and repair of public buildings	1,642.56			
Roads and bridges	199.86			
Contingent expenses	1,989.82			
Total expenditures	101,009.52		7.00	
Miscellaneous credits:				
Exchanges of currency	3,108.30		3,190.61	
Payments to municipalities		212,619.34		

PROVINCE OF OCCIDENTAL NEGROS—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
CREDITS—continued.				
Miscellaneous credits—Continued.				
Repayments of loans to insular government	₱4,000.00			
Refund of advances, act No. 799	2,625.02			
Total miscellaneous credits	9,733.32	₱212,619.34	Pfs. 3,190.61	
Balance June 30, 1906	97,996.35	22,880.74	1,407.05	
Total credits	208,739.19	235,500.08	4,604.66	

THE PROVINCE OF ORIENTAL NEGROS.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	24,316.47	11,352.86	20,486.97	
Revenues:				
All provincial—				
Registry of property	177.84			
Miscellaneous	16.75		.16	
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 83	770.00			
Cart	42.50			
Land general	11,568.92			
Land, road and bridge	5,784.63			
Cedulas, act No. 1189	22,015.50			
Insular refund internal revenue, act No. 1189	17,350.82			
Municipal portion of joint provincial-municipal—				
Cedulas, act No. 83		770.00		
Cart		42.50		
Land		21,539.29		
Cedulas, act No. 1189		22,015.50		
Insular refund internal revenue, act 1189		25,454.69		
All municipal—				
Fisheries		1,156.70		
Ownership and transfer of cattle		6,463.00		
Rents, profits, and privileges		4,447.22		
Licenses		1,580.09		
Fines		1,367.35		
Licenses, act No. 1189		5,700.00		
Sales of estray animals, act No. 1147		96.00		
Opium certificates, act No. 1461		60.00		
Miscellaneous		14.00		
Non-Christian inhabitants—Insular refund internal revenue	1,679.86			
Total revenues	59,406.82	90,706.34	.16	
Miscellaneous receipts:				
Payments to province—				
Insular appropriation in lieu of land tax, act 1455	8,247.36	10,512.28		
School building fund, act No. 1275	6,000.00			
Loan to province, act No. 1018	20,000.00			
Repayments of loans by municipalities	482.50			
Exchanges of currency	32,555.73		21,221.90	
Sales of galvanized iron, Congressional relief	501.79			
Total miscellaneous receipts	67,787.38	10,512.28	21,221.90	
Total debits	151,510.67	112,571.48	41,709.03	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	28,558.43			
Construction and repair of public buildings	4,086.78			
Roads and bridges	7,042.02			
Contingent expenses	12,237.17			

THE PROVINCE OF ORIENTAL NEGROS—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
CREDITS—continued.				
Expenditures—Continued.				
Congressional relief funds—				
Salaries	₱266.66			
Construction and repair of public buildings	720.09			
Roads and bridges	3,859.85			
Contingent expenses	30.41			
Total expeditures	56,801.41			
Miscellaneous credits:				
Exchanges of currency	16,324.48		Pfs. 41,709.03	
Payments to municipalities		₱102,904.00		
Total miscellaneous credits	16,324.48	102,904.00	41,709.03	
Balance June 30, 1906	78,384.78	9,667.48		
Total credits	151,510.67	112,571.48	41,709.03	

THE PROVINCE OF PALAWAN.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	4,565.81	3,874.70		
Revenues:				
All provincial—				
Prison labor	67.42			
Fees justice of peace	141.40			
Road tax, act No. 1396	1,798.00			
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 1189	2,809.00			
Insular refund internal revenue, act No. 1189	2,376.37			
Municipal portion of joint provincial-municipal—				
Cedulas, act No. 1189		2,759.50		
Insular refund internal revenue, act No. 1189		4,112.88		
All municipal—				
Fisheries		329.50		
Ownership and transfer of cattle		5,261.00		
Rents, profits, and privileges		726.56		
Licenses		383.00		
Fines		992.79		
Licenses, act No. 1189		155.00		
Property tax		1,944.21		
Cedulas		14.00		
Township and settlement—				
Insular refund internal revenue, act No. 1189	694.18			
Cedulas, act No. 1189	49.50			
Opium certificates, act No. 1461	10.00			
Total revenues	7,945.87	16,678.44		
Miscellaneous receipts:				
Payments to province—				
School buildings fund, act No. 1275	4,000.00			
Cancellation of loans to province, act No. 1361	20,615.38			
General provincial purpose, act No. 1416	12,500.00			
School fund, act No. 1361	1,660.00			
Purchase of sailboat, act No. 1478	9,000.00			
Exchanges of currency	578.96		1,363.74	
Amount unapportioned internal revenue	443.41			
Total miscellaneous receipts	48,797.75		1,363.74	
Total debits	61,309.43	20,553.14	1,363.74	

THE PROVINCE OF PALAWAN—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	₱7,450.00			
Construction and repair of public buildings	94.60			
Contingent expenses	9,477.80			
School building fund, act No. 1275	3,682.63			
School fund, act No. 136	403.18			
Purchase of sailboat, act No. 1478	3,000.00			
Total expenditures	24,108.21			
Miscellaneous credits:				
Exchanges of currency	1,049.01		Pfs. 752.65	
Payments to municipalities		₱15,773.84		
Repayment of loans to insular government, act No. 1361	20,615.38			
Amount unapportioned internal revenue		443 41		
Total miscellaneous credits	21,664.39	16,217.25	752.65	
Balance June 30, 1906	15,536.83	4,335.89	611.09	
Total credits	61,309.43	20,553.14	1,363.74	

THE PROVINCE OF PAMPANGA.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱114,129.51	₱12,047.42		
Revenues:				
All provincial—Registry of property	462.87			
Provincial portion of joint provincial-municipal—				
Cart	1,720.88			
Land, general fund	7,697.09			
Land, road and bridge fund	3,848.75			
Cedulas, act No. 1189	24,107.50			
Insular refund internal revenue, act No. 1189	20,088.16			
Municipal portion of joint provincial-municipal—				
Cart		1,720.87		
Land		14,134.09		
Cedulas, act No. 1189		24,107.50		
Insular refund internal revenue, act No. 1189		30,057.68		
All municipal—				
Fisheries		1,832.35		
Ownership and transfer of cattle		16,286.00		
Rents, profits, and privileges		20,097.79		
Licenses		5,930.23		
Fines		2,271.24		
Licenses, act No. 1189		4,229.50		
Opium certificates, act No. 1461		400.00		
Sales of estray animals, act No. 1147		502.00		
Non-Christian inhabitant—Insular refund internal revenue, act No. 1189	74.57			
Total revenues	57,999.82	121,569.25		
Miscellaneous receipts:				
Payments to provinces—				
Insular appropriation in lieu of land tax, act No. 1455	47,214.75	56,916.78		
School buildings fund, act No. 1275	12,000.00			
Public contributions school buildings fund	17,409.78			
Repayment of loans by municipalities	1,750.00			
Exchanges of currency	4,339.75		Pfs. 5,641.60	
Sales of galvanized iron, Congressional relief	1,115.52			
Total miscellaneous receipts	83,829.80	56,916.78	5,641.60	
Total debits	255,959.13	190,533.45	5,641.60	

THE PROVINCE OF PAMPANGA—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	₱47,928.91			
Construction and repair public buildings	5,628.13			
Roads and bridges	21,159.09			
Contingent expenses	24,962.41			
Purchase of land	4,424.15			
School buildings funds, act No. 1275	250.00			
Congressional relief funds—Roads and bridges	1,115.52			
Total expenditures	105,468.21			
Miscellaneous credits:				
Exchanges of currency	4,339.71		Pfs. 5,641.60	
Payments to municipalities		₱173,152.72		
Joint provincial-municipal revenue—Refund industrial tax	144.30	144.29		
Total miscellaneous credits	4,484.01	173,297.01	5,641.60	
Balance June 30, 1906	146,006.91	17,236.44		
Total credits	255,959.13	190,533.45	5,641.60	

THE PROVINCE OF PANGASINAN.

DEBITS.				
Balance July 1, 1905	₱96,780.46	₱32,188.56	Pfs. 26,480.38	
Revenues:				
All provincial—				
Registry of property	9,354.23			
Mining fees	18.00			
Prison labor	3.50			
Miscellaneous	42.08			
Provincial portion of joint provincial-municipal—				
Industrial	57.20			
Cedulas, act No. 83	2,521.00			
Cart	7,973.86			
Land, general	12,570.74			
Land, road and bridge	6,360.99			
Cedulas, act No. 1189	53,013.50			
Insular refund internal revenue, act No. 1189	39,728.60			
Municipal portion of joint provincial-municipal—				
Industrial		57.20		
Cedulas, act No. 83		2,521.00		
Cart		7,973.84		
Land		24,939.51		
Cedulas, act No. 1189		53,013.50		
Insular refund internal revenue, act No. 1189		59,362.95		
All municipal—				
Fisheries		10,424.86		
Ownership and transfer of cattle		28,080.00		
Rents, profits, and privileges		45,900.41		
Licenses		15,970.87		
Fines		15,285.71		
Licenses, act No. 1189		13,302.09		
Sales of estray animals, act No. 1147		5,985.59		
Opium certificates act No. 1461		635.00		
Miscellaneous		1,341.02		
Non-Christian inhabitant—Insular refund internal revenue	229.94			
Total revenues	131,873.64	284,793.55		
Miscellaneous receipts:				
Payments to province—Insular appropriations in lieu of land tax, act No. 1455	39,300.14	50,616.26		
Repayments of loans by municipalities	500.00			

THE PROVINCE OF PANGASINAN—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Miscellaneous receipts—Continued.				
Payment by Zambales Province, balance due annexed municipalities		₱52.74		
Exchanges of currency	₱62,486.33		Pfs. 56,337.60	Pfs. 18.88
Total miscellaneous receipts	102,286.47	50,669.00	56,337.60	18.88
Total debits	330,940.57	367,651.11	82,817.98	18.88
CREDITS.				
Balance July 1, 1905				14.42
Expenditures:				
Provincial funds—				
Salaries	55,812.11			
Construction and repair of public buildings	14,127.22			
Roads and bridges	74,116.13			
Contingent expenses	60,044.52		25.00	
Total expenditures	204,099.98		25.00	14.42
Miscellaneous credits:				
Exchanges of currency	43,336.57	14.52	80,986.97	
Payments to municipalities		334,197.97		
Loans to municipalities	500.00			
Total miscellaneous credits	43,836.57	334,212.49	80,986.97	
Balance June 30, 1906	83,004.02	33,438.62	1,806.01	4.46
Total credits	330,940.57	367,651.11	82,817.98	18.88

THE PROVINCE OF RIZAL.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱37,430.18	₱7,948.20		
Revenues:				
All provincial—				
Registry of property	428.61			
Miscellaneous	27.72			
Provincial portion of joint provincial-municipal—				
Industrial	15.87			
Cedulas, act No. 83	126.00			
Cart	279.90			
Land, general	14,099.54			
Land, road, and bridge	6,912.25			
Cedulas, act No. 1189	19,400.50			
Insular refund internal revenue, act No. 1189	13,549.55			
Municipal portion of joint provincial-municipal—				
Industrial		16.23		
Cedulas, act No. 83		127.00		
Cart		279.75		
Land		17,469.11		
Cedulas, act No. 1189		19,400.50		
Insular refund internal revenue, act No. 1189		20,159.91		
All municipal—				
Fisheries		3,653.41		
Ownership and transfer of cattle		3,634.00		
Rents, profits, and privileges		44,983.23		
Licenses		17,828.09		
Fines		6,589.36		
Licenses, act No. 1189		14,492.50		
Sales of estray animals, act No. 1147		961.57		
Opium certificates, act No. 1461		275.00		
Cemeteries		45.50		
Franchise tax, act No. 1112		1,614.89		
Non-Christian inhabitants—Insular refund internal revenue, act No. 1189	164.41			
Total revenues	55,004.35	151,530.05		

THE PROVINCE OF RIZAL—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	₱22,978.28	₱27,131.50		
School buildings fund, act No. 1275	7,000.00			
Reimbursement taxes deposited insular treasury, act No. 436	758.94			
Public contributions school buildings fund	8,000.00			
Repayment of loans by municipalities	664.71			
Exchanges of currency	724.62		Pfs.942.00	
Total miscellaneous receipts	40,126.55	27,131.50	942.00	
Total debits	132,561.08	186,609.75	942.00	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	35,187.92			
Construction and repair of public buildings	777.94			
Roads and bridges	8,001.08			
Contingent expenses	25,061.72			
School building fund, act No. 1275	13,537.70			
Congressional relief funds—				
Construction and repair of public buildings	375.06			
Roads and bridges	82.39			
Contingent expenses	14.00			
Total expenditures	83,037.81			
Miscellaneous credits:				
Exchanges of currency	724.62		942.00	
Payments to municipalities		172,412.07		
Repayments of loans to insular government	5,000.00			
Total miscellaneous credits	5,724.62	172,412.07	942.00	
Balance June 30, 1906	43,798.65	14,197.68		
Total credits	132,561.08	186,609.75	942.00	

THE PROVINCE OF ROMBLON.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱17,964.62	₱1,446.61	Pfs.306.04	
Revenues:				
All provincial—Registry of property	8.50			
Provincial portion of joint provincial-municipal—				
Industrial	13.13			
Cedulas, act No. 83	940.00			
Cart	22.50			
Land, general	1,596.92			
Land, road and bridge	798.41			
Cedulas, act No. 1189	6,552.00			
Insular refund internal revenue, act No. 1189	4,185.60			
Municipal portion of joint provincial-municipal—				
Industrial		13.12		
Cedulas, act No. 83		940.00		
Cart		22.50		
Land		2,732.76		
Cedulas, act No. 1189		6,552.00		
Insular refund internal revenue, act No. 1189		7,116.87		
All municipal:				
Fisheries		380.67		
Ownership and transfer of cattle		4,446.00		
Rents, profits, and privileges		4,022.75		

THE PROVINCE OF ROMBLON—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Revenues—Continued.				
All municipal—Continued.				
Licenses		₱1,201.56		
Fines		1,447.69		
Licenses, act No. 1189		571.50		
Sales of estray animals, act No. 1147		117.20		
Opium certificates, act No. 1461		140.00		
Total revenues	₱14,117.06	29,704.62		
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	3,003.70	3,212.86		
School buildings fund, act No. 1275	8,000.00			
Exchanges of currency	345.32		Pfs. 432.30	
Received from Capiz Province, erroneous refund of forestry	1.14	1.14		
Total miscellaneous receipts	11,350.16	3,214.00	432.30	
Total debits	43,431.84	34,365.23	738.34	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	10,908.60			
Construction and repair of public buildings	331.29			
Contingent expenses	4,218.13			
School building fund, act No. 1275	7,788.64			
Congressional relief funds—				
Construction and repair of public buildings	76.35			
Contingent expenses	113.50			
Total expenditures	23,436.51			
Miscellaneous credits:				
Exchanges of currency	332.32		440.34	
Payments to municipalities		31,987.21		
Total miscellaneous credits	332.32	31,987.21	440.34	
Balance June 30, 1906	19,663.01	2,378.02	298.00	
Total credits	43,431.84	34,365.23	738.34	

THE PROVINCE OF SAMAR.

DEBITS.				
Balance July 1, 1905	₱13,736.81	₱14,254.64	Pfs. 184.10	
Revenues:				
All provincial—				
Registry of property	170.80			
Fares provincial launch	1,473.12			
Miscellaneous	276.60			
Provincial portion of joint provincial-municipal—				
Cart	34.17			
Land, general	8,581.73			
Land, road and bridge	4,290.75			
Cedulas, act No. 1189	29,497.00			
Insular refund internal revenue, act No. 1189	17,724.08			
Municipal portion of joint provincial-municipal:				
Cart		34.17		
Land		17,163.35		
Cedulas, act No. 1189		29,497.00		
Insular refund internal revenue, act No. 1189		35,806.58		

THE PROVINCE OF SAMAR—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—Continued.				
Revenues—Continued.				
All municipal—				
Fisheries		₱3,767.62		
Ownership and transfer of cattle		3,324.50		
Rents, profits, and privileges		2,740.79		
Licenses		11,155.35		
Fines		3,595.11		
Licenses, act No. 1189		1,672.00		
Miscellaneous		343.00		
Non-Christian inhabitants—Insular refund internal revenue, act No. 1189	₱46.72			
Total revenues	62,094.97	109,099.47		
Miscellaneous receipts:				
Payments to province—				
Insular appropriation in lieu of land tax, act No. 1455	9,279.27	12,372.14		
School buildings fund, act No. 1406	2,000.00			
Loan to province, act No. 1389	25,000.00			
Repayments of loans by municipalities	125.00			
Exchanges of currency	1,864.28		Pfs. 2,327.21	
Total miscellaneous receipts	38,268.55	12,372.14	2,327.21	
Total debits	114,100.33	135,726.25	2,511.31	
CREDITS.				
Expenditures:				
Provincial—				
Salaries	41,629.39			
Construction and repair of public buildings	106.05			
Roads and bridges	2,064.84			
Contingent expenses	46,735.29		39.00	
Maintenance municipal police, act No. 781	350.00			
Congressional relief funds—Roads and bridges	666.76			
Total expenditures	91,552.33		39.00	
Miscellaneous credits:				
Exchanges of currency	1,789.29		2,421.76	
Payments to municipalities		115,857.11		
Loans to municipalities	1,500.00			
Joint provincial-municipal revenue—Refund industrial tax	1.92	1.92		
Total miscellaneous credits	3,291.21	115,859.03	2,421.76	
Balance June 30, 1906	19,256.79	19,867.22	50.55	
Total credits	114,100.33	135,726.25	2,511.31	

THE PROVINCE OF SORSOGON.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱39,761.22	₱7,573.50		
Revenues:				
Sorsogon—				
All provincial—				
Registry of property	244.57			
Rental of provincial property	180.00			
Mining fees	50.40			
Miscellaneous	106.12			
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 83	722.60			
Land, general	2,785.59			
Land, road and bridge	1,474.78			
Cedulas, act No. 1189	16,131.10			
Insular refund internal revenue, act No. 1189	8,310.80			

THE PROVINCE OF SORSOGON—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Revenues—Continued.				
Sorsogon—Continued.				
Municipal portion of joint provincial-municipal—				
Cedulas, act No. 83		₱731.00		
Land		7,427.62		
Cedulas, act No. 1189		19,360.00		
Insular refund internal revenue, act No. 1189		20,642.26		
All municipal:				
Fisheries		5,568.22		
Ownership and transfer of cattle		3,153.00		
Rents, profits, and privileges		18,336.35		
Licenses		13,610.62		
Fines		6,334.45		
Licenses, act No. 1189		10,695.00		
Opium certificates, act No. 1461		720.00		
Miscellaneous		137.15		
Non-Christian inhabitants—Insular refund of internal revenue, act No. 1189	₱2.79			
Total revenues, Sorsogon	30,008.75	106,715.67		
Balance subprovince of Masbate, Jan. 1, 1906	1,407.75	1,148.73	Pfs. 1,125.25	
Subprovince of Masbate, Jan. 1 to June 30, 1906—				
All provincial—Mining fees	117.60			
Provincial portion of joint provincial-municipal—				
Cedulas, act No. 83	8.40			
Land, general	382.68			
Land, road and bridge	382.62			
Cedulas, act No. 1189	3,228.90			
Insular refund internal revenue, act No. 1189	1,642.94			
Total revenues, subprovince of Masbate	5,763.14			
Miscellaneous receipts:				
Sorsogon—				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	17,973.08	29,503.99		
School-buildings fund, act No. 1275	12,000.00			
Public contributions school-building fund	5,661.11			
Total miscellaneous receipts, Sorsogon	35,634.19	29,503.99		
Subprovince of Masbate, Jan. 1 to June 30, 1906—				
Payments to province—Insular appropriations in lieu of land tax, act No. 1455	2,401.24			
Exchanges of currency	865.58			
Total miscellaneous receipts, subprovince of Masbate	3,266.82			
Total debits	115,841.87	144,941.89	1,125.25	
CREDITS.				
Expenditures:				
Sorsogon—				
Provincial funds—				
Salaries	36,808.43			
Construction and repair of public buildings	36.80			
Roads and bridges	6,167.80			
Contingent expenses	13,435.39			
School-building fund, act No. 1275	18,726.49			
Total expenditures, Sorsogon	75,174.91			

THE PROVINCE OF SORSOGON—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
CREDITS—continued.				
Expenditures—Continued.				
Subprovince of Masbate, Jan. 1 to June 30—				
Provincial funds—				
Salaries	₱1,900.10			
Contingent expenses	3,040.19			
Total expenditures, subprovince of Masbate	4,940.29			
Miscellaneous credits:				
Sorsogon—Payments to municipalities		₱122,502.95		
Total miscellaneous credits, Sorsogon		122,502.95		
Subprovince of Masbate, Jan. 1 to June 30, 1906—Exchanges of currency			Pfs. 1,125.25	
Total miscellaneous credits, subprovince of Masbate			1,125.25	
Balance June 30, 1906, Sorsogon	30,229.25	22,438.94		
Balance June 30, 1906, subprovince of Masbate	5,497.42			
Total credits	115,841.87	144,941.89	1,125.25	

THE PROVINCE OF SURIGAO.

DEBITS.				
Balance July 1, 1905	₱22,070.73	₱7,365.58	Pfs. 1,847.35	
Revenues:				
All provincial—				
Registry of property	82.02			
Rental of provincial property	440.00			
Fares, provincial launch	28.45			
Miscellaneous	19.23			
Provincial portion of joint provincial municipal—				
Cedulas, act No. 83	641.00			
Land, general	3,731.80			
Land, road and bridge	1,876.05			
Cedulas, act No. 1189	12,025.00			
Insular refund internal revenue, act No. 1189	7,654.64			
Municipal portion of joint provincial municipal—				
Cedulas, act No. 83		645.00		
Land		7,415.01		
Cedulas, act No. 1189		12,025.00		
Insular refund internal revenue, act No. 1189		14,410.35		
All municipal—				
Fisheries		511.55		
Ownership and transfer of cattle		4,209.00		
Rents, profits, and privileges		1,477.91		
Licenses		1,677.85		
Fines		1,941.50		
Licenses, act No. 1189		390.00		
Opium certificates, act No. 1461		645.00		
Miscellaneous		3,515.75		
Non-Christian inhabitants—Insular refund internal revenue, act No. 1189	1,073.91			
Total revenues	27,572.10	48,863.92		
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	6,701.90	8,717.63		
School building fund, act No. 1275	16,000.00			
Return seized funds deposited insular treasury, Apr. 29, 1900	4,111.60			

THE PROVINCE OF SURIGAO—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Miscellaneous receipts—Continued.				
Exchanges of currency	₱1,592.50		Pfs. 1,055.72	
Public contributions school building fund	9,920.98			
Total miscellaneous receipts	38,326.98	₱8,717.63	1,055.72	
Total debits	87,969.81	64,947.13	2,903.07	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	19,437.02			
Construction and repair of public buildings	1,841.30			
Roads and bridges	156.74			
Contingent expenses	12,969.14			
School building fund, act No. 1275	238.72			
Total expenditures	34,642.92			
Miscellaneous credits:				
Exchanges of currency	811.84		1,957.35	
Payments to municipalities		60,175.63		
Repayments of loans to insular government	4,000.00			
Total miscellaneous credits	4,811.84	60,175.63	1,957.35	
Balance June 30, 1906	48,515.05	4,771.50	945.72	
Total credits	87,969.81	64,947.13	2,903.07	

THE PROVINCE OF TARLAC.

DEBITS.				
Balance July 1, 1905	₱19,717.63	₱3,911.46		
Revenues:				
All provincial—				
Registry of property	409.45			
Miscellaneous	.33		Pfs. 0.02	
Provincial portion of joint provincial-municipal—				
Cedula, act No. 83	577.00			
Cart	3,357.06			
Land, general	5,035.08			
Land, road and bridge	2,517.74			
Cedula, act No. 1189	18,625.50			
Insular refund internal revenue, act No. 1189	11,310.34			
Municipal portion of joint provincial-municipal—				
Industrial		24.74		
Cedula, act No. 83		577.00		
Cart		3,357.03		
Land		9,682.94		
Cedula, act No 1189		18,625.50		
Insular refund internal revenue, act No. 1189		18,033.24		
All municipal—				
Fisheries		4,349.26		
Ownership and transfer of cattle		9,905.20		
Rents, profits, and privileges		12,416.27		
Licenses		4,807.20		
Fines		4,132.02		
Licenses, act No. 1189		5,162.84		
Opium certificates, act No. 1461		260.00		
Sales of estray animals, act No. 1147		2,933.35		
Miscellaneous		450.80		
Non-Christian inhabitant—Insular refund internal revenue, act No. 1189	161.25			
Total revenues	41,993.75	94,717.39	.02	

THE PROVINCE OF TARLAC—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Miscellaneous receipts:				
Payments to province—				
Insular appropriation in lieu of land tax, act No. 1455	₱11,351.45	₱14,228.21		
Construction of dike, act No. 1406	16,000.00			
Loans to province	50,000.00			
Public contributions, Tarlac Dike fund	3,546.54			
Exchanges of currency	3,917.53		Pfs. 7,694.48	
Total miscellaneous receipts	84,815.52	14,228.21	7,694.48	
Total debits	146,526.90	112,857.06	7,694.50	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	27,058.49			
Construction and repair public buildings	2,053.80			
Roads and bridges	7,728.42			
Contingent expenses	16,652.02			
Tarlac Dike fund	6,662.75			
Total expenditures	60,155.48			
Miscellaneous credits:				
Exchange of currency	5,918.75		5,092.30	
Payments to municipalities		104,238.17		
Losses, section 41, act No. 1402	67.90			
Provincial portion of joint provincial-municipal—Refund industrial tax.	15.32			
Total miscellaneous credits	6,001.97	104,238.17	5,092.30	
Balance June 30, 1906	80,369.45	8,618.89	2,602.20	
Total credits	146,526.90	112,857.06	7,694.50	

THE PROVINCE OF TAYABAS.

DEBITS.				
Balance July 1, 1905	₱83,180.89	₱36,032.74	Pfs. 9,175.87	Pfs. 46.71
Revenues:				
All provincial—				
Registry of property	74.55			
Mining fees	16.00			
Miscellaneous			.45	
Provincial portion of joint provincial-municipal—				
Industrial	131.21			
Cedulas, act No. 83	450.00			
Cart	118.15			
Land, general	24,124.68			
Land, road and bridge	12,062.34			
Cedulas, act No. 1189	23,416.00			
Insular refund internal revenue, act No. 1189	9,111.92			
Municipal portion of joint provincial-municipal—				
Industrial		130.71		
Cedulas, act No. 83		450.00		
Cart		118.15		
Land		48,200.87		
Cedulas, act No. 1189		23,416.00		
Insular refund internal revenue, act No. 1189		27,381.20		
All municipal—				
Fisheries		3,453.03		
Ownership and transfer of cattle		20,190.00		
Rents, profits, and privileges		14,652.78		
Licenses		13,449.66		
Fines		7,479.44		
Licenses, act No. 1189		7,490.00		
Sales of estray animals, act No. 1147		348.95		
Opium certificates, act No. 1461		180.00		

THE PROVINCE OF TAYABAS—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Revenues—Continued.				
Non-Christian inhabitants—Insular refund internal revenue, act No. 1189.	₱190.35			
Total revenues	69,695.20	₱166,940.79	Pfs.0.45	
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	54,247.75	72,208.66		
School building fund, act No. 1275	12,775.00			
Received from former treasurer, Marinduque Province, act No. 499	50.00			
Repayments of loans by municipalities	2,005.00			
Sales of rice, Congressional relief	1,165.22			
Exchanges of currency	13,776.35	42.41	9,144.37	
Total miscellaneous receipts	84,019.32	72,251.07	9,144.37	
Total debits	236,895.41	275,224.60	18,320.69	Pfs.46.71
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	52,726.45			
Construction and repair of public buildings	473.71			
Roads and bridges	32,366.62			
Contingent expenses	44,299.07			
School building fund, act No. 1275	25,639.00			
Congressional relief funds—Roads and bridges	8,803.12			
Total expenditures	164,307.97			
Miscellaneous credits:				
Exchanges of currency	7,148.93		17,567.64	46.71
Payments to municipalities		244,495.51		
All provincial revenue—Refund miscellaneous tax	27.58			
Total miscellaneous credits	7,176.51	244,495.51	17,567.64	46.71
Balance June 30, 1906	65,410.93	30,729.09	753.05	
Total credits	236,895.41	275,224.60	18,320.69	46.71

THE PROVINCE OF MARINDUQUE.

DEBITS.				
Balance July 1, 1905	₱50.00			
Total debits	50.00			
CREDITS.				
Payment to Tayabas Province, act No. 499	50.00			
Total credits	50.00			

The province of Marinduque was annexed to the province of Tayabas on November 10, 1902, under the provisions of act No. 499.

THE PROVINCE OF LA UNION.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱2,681.70	₱11,315.85	Pfs. 12,829.58	
Revenues:				
All provincial—				
Registry of property	46.70			
Rental of provincial property	392.50			
Registry of medical certificates, act No. 310	10.00			
Provincial portion of joint provincial-municipal—				
Industrial	2.50			
Cedulas, act No. 83	160.00			
Cart	1,149.75			
Land, general	20,701.92			
Land, road, and bridge	10,350.86			
Cedulas, act No. 1189	15,669.50			
Insular refund internal revenue, act No. 1189	9,176.30			
Municipal portion of joint provincial-municipal—				
Industrial		2.50		
Cedulas, act No. 83		160.00		
Cart		1,149.75		
Land		41,412.18		
Cedulas, act No. 1189		15,669.50		
Insular refund internal revenue, act No. 1189		17,879.84		
All municipal—				
Fisheries		2,404.76		
Ownership and transfer of cattle		15,568.00		
Rents, profits, and privileges		12,250.08		
Licenses		2,044.30		
Fines		2,740.51		
Licenses, act No. 1189		2,860.00		
Sales of estray animals, act No. 1147		243.54		
Opium certificates, act No. 1461		35.00		
Non-Christian inhabitants—Insular refund internal revenue, act No. 1189	682.49			
Total revenues	58,342.52	114,419.96		
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	14,304.93	19,073.19		
School buildings fund, act No. 1275	12,000.00			
Repayment of loans by municipalities	468.29			
Sales of rice, Congressional relief	30.83			
Exchanges of currency	10,355.98			
Total miscellaneous receipts	37,160.03	19,073.19		
Total debits	98,184.25	144,809.00	12,829.58	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	32,225.41			
Construction and repair of public buildings	605.42			
Roads and bridges	13,524.03			
Contingent expenses	12,622.38			
Purchase of land	1,395.00			
School buildings fund, act No. 1275	4,065.46			
Congressional relief funds—Construction and repair of public buildings	83.19			
Total expenditures	64,520.89			
Miscellaneous credits.				
Payments to municipalities		117,024.42		
Losses, section 41, act No. 1402	471.63		37.30	
Exchanges of currency			12,792.28	
Total miscellaneous credits	471.63	117,024.42	12,829.58	
Balance June 30, 1906	33,191.73	27,784.58		
Total credits	98,184.25	144,809.00	12,829.58	

THE PROVINCE OF ZAMBALES.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS.				
Balance July 1, 1905	₱9,024.46	₱1,701.85	Pfs. 109.87	
Revenues:				
All provincial—				
Registry of property	155.51			
Mining fees	12.00			
Sales of estray animals, act No. 877	658.66			
Provincial portion of joint provincial-municipal—				
Industrial	34.70			
Cedulas, act No. 83	137.00			
Cart	384.55			
Land, general	2,959.40			
Land, road, and bridge	1,479.89			
Cedulas, act No. 1189	7,017.50			
Insular refund internal revenue, act No. 1189	6,421.14			
Municipal portion of joint provincial-municipal—				
Industrial		34.67		
Cedulas, act No. 83		137.00		
Cart		384.55		
Land		4,904.72		
Cedulas, act No. 1189		7,017.50		
Insular refund internal revenue, act No. 1189		7,750.10		
All municipal—				
Fisheries		2,315.56		
Ownership and transfer of cattle		2,839.00		
Rents, profits, and privileges		2,803.21		
Licenses		1,571.54		
Fines		1,422.76		
Licenses, act No. 1189		1,445.00		
Sales of estray animals, act No. 1147		15.00		
Opium certificates, act No. 1461		90.00		
Cemeteries		43.50		
Miscellaneous		12.30		
Non-Christian inhabitants—Insular refund of internal revenue, act No. 1189	320.48			
Total revenues	19,580.83	32,786.41		
Miscellaneous receipts:				
Payments to province—				
Insular appropriations in lieu of land tax, act No. 1455	4,960.64	5,450.45		
School buildings funds, act No. 1275	8,000.00			
General provincial purpose, act No. 1416	5,000.00			
Exchanges of currency	2,086.59		2,294.24	
Public contributions, school buildings funds	3,298.07			
Total miscellaneous receipts	23,345.30	5,450.45	2,294.24	
Total debits	51,950.59	39,938.71	2,404.11	
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	16,506.49			
Construction and repair of public buildings	22.60			
Roads and bridges	2,359.81			
Contingent expenses	7,080.29			
Congressional relief funds—Construction and repair of public buildings	143.81			
Total expenditures	26,113.00			
Miscellaneous credits:				
Exchanges of currency	2,437.46		1,837.97	
Payments to municipalities		36,107.56		

THE PROVINCE OF ZAMBALES—Continued.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
CREDITS—continued.				
Miscellaneous credits—Continued.				
Payment to Pangasinan Province, balance due annexed municipalities		₱52.74		
Total miscellaneous credits	₱2,437.46	36,160.30	Pfs. 1,837.97	
Balance June 30, 1906	23,400.13	3,778.41	566.14	
Total credits	51,950.59	39,938.71	2,404.11	

CONSOLIDATION OF THE GENERAL ACCOUNTS OF PROVINCIAL TREASURERS.

DEBITS.				
Balance July 1, 1905	1,745,737.63	382,143.10	151,803.07	Pfs. 1,211.35
Revenues:				
All provincial—				
Registry of property	23,257.21			
Registry of mining claims	1,015.75			
Rental of provincial property	1,647.25			
Justice of peace fees, act No. 1396	516.30			
Road tax, act No. 1396	36,204.00			
Prison labor	4,603.38			
Registry of medical certificates, act No. 310	20.00			
Fares provincial launches	2,134.00			
Sales of estrays, act No. 877	2,865.66			
Sheriff fees, act No. 176	69.20			
Miscellaneous	1,363.79		21.68	
Moro—				
Sales articles manufactured trade schools	470.90			
Cedulas	20,369.69			
Land court fees	7.17			
Land	46,936.69			
Moro exchange	2,908.34			
Fines	1,802.00			
Shell-fishing licenses	3,375.00			
Arms permits	1,309.00			
Sales Chinese tobacco	1,395.20			
Sales products San Ramon farm	4,627.70			
Arrastre plant, Jolo, act No. 1432	2,060.21			
Insular refund of internal revenue, act No. 1189	80,056.45			
Cedulas, act No. 1189	26,596.00			
Customs revenue	324,089.46			
Provincial portion of joint provincial-municipal—				
Industrial	1,084.29			
Cedulas, act No. 83	20,528.26		1.12	
Land, general	352,517.72			
Land, road and bridge	195,592.99			
Cedulas, act No. 1189	803,837.00			
Cart	30,964.86			
Stamp	18.75			
Franchise tax, act No. 1111	102.04			
Insular refund of internal revnue, act No. 1189	528,956.94			
Municipal portion of joint provincial-municipal—				
Industrial		1,306.68		
Cedulas, act No. 83		20,150.50		
Land		696,259.28		
Cart		30,964.46		
Cedulas, act No. 1189		803,609.50		
Stamp		18.76		
Franchise tax, act No. 1111		204.04		
Insular refund of internal revenue, act No. 1189		910,507.33		
All municipal—				
Fisheries		122,835.34		69.18
Ownership and transfer of cattle		362,435.27		14.56

CONSOLIDATION OF THE GENERAL ACCOUNTS OF PROVINCIAL TREASURERS—Con.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Revenues—Continued.				
All municipal—Continued.				
Rents, profits, and privileges		₱616,563.30		Pfs.246.68
Licenses		324,553.63		77.85
Fines		161,673.99		93.29
Licenses, act No. 1189		198,107.33		
Opium certificates, act No. 1461		12,395.00		
Sales of estray animals, act No. 1147		25,414.87		
Cemeteries, act No. 1458		209.45		
Personal tax, act No. 387		610.00		
Property tax, act No. 387		14,111.62		
Cart, act No. 387		605.75		
Franchise tax, act No. 1112		1,614.89		
Miscellaneous		11,548.63		
Non-Christian inhabitants—				
Insular refund of internal revenue, act No. 1189	₱14,659.46			
Ownership and transfer of cattle	166.00			
Cedulas, act No. 1189	178.00			
Township and settlement—				
Insular refund internal revenue, act No. 1189	20,599.74			
Cedulas, act No. 1189	49.50			
Opium certificates, act No. 1461	10.00			
Total revenues	2,558,965.90	4,315,699.62	Pfs.22.80	501.56
Miscellaneous receipts:				
Payments to provinces—				
Insular appropriations in lieu of land tax—				
Act 1455 [a]	585,741.15	731,953.15		
Act 1475 [a]	6,926.01	9,234.68		
School buildings funds—				
Act No. 1275 [b]	266,500.61			
Act No. 1406 [b]	2,000.00			
Act No. 1361 [a]	1,660.00			
Aid to municipality of Santa, act No. 1406 [b]	5,000.00			
Construction of pier, act No. 1406 [b]	6,000.00			
Construction of dike, act No. 1406 [b]	16,000.00			
Provincial building fund, act No. 1416 [a]	30,000.00			
School assistance funds, act No. 797 [b]	6,000.00			
Purchase of sailboat, act No. 1478 [a]	9,000.00			
Cancellation of loans, act No. 1361 [a]	20,615.38			
Padre Juan Villaverde trail, act No. 920 [b]	3,910.31			
Cancellation of loans, act No. 1413 [a]	5,000.00			
Roads and bridges, act No. 1198 [b]	60.41			
Relief Cavite Province [b]	20,000.00			
General provincial purposes [a]	140,446.28			
Repayment of loans by municipalities	26,044.01			
Unapportioned internal revenue refunds, act No. 1426	7,889.45			
Aid to municipal schools, act No. 1478 [a]		13,877.68		
Public contributions dike, act No. 1406	3,546.54			
Return seized funds deposited insular treasury [a]	4,111.60			
Reimbursement taxes deposited insular treasury, act No. 436	758.94			
Sales of galvanized iron, Congressional relief	1,931.15			
Sales of rice, Congressional relief [b]	9,304.19			
Public contributions school buildings' funds	79,573.63			
Forestry refunds to municipalities erroneously charged provincial		2,419.25		
Appropriation subprovince of Catanduanes	777.49			
Return of insular deposits [a]	392.70			
Loans to provinces—				
Insular	161,000.00			
Congressional relief	24,383.71			

[a] From insular revenues.

[b] From Congressional relief funds.

CONSOLIDATION OF THE GENERAL ACCOUNTS OF PROVINCIAL TREASURERS—Con.

	Philippine currency.		Mexican and Spanish-Filipino currency.	
	Provincial.	Municipal.	Provincial.	Municipal.
DEBITS—continued.				
Miscellaneous receipts—Continued.				
Exchanges of currency	₱354,967.76	₱3,965.43	Pfs. 334,141.90	Pfs. 4,673.82
Total miscellaneous receipts	1,799,541.32	761,450.19	334,141.90	4,673.82
Total debits	6,104,244.85	5,459,292.91	485,967.77	6,386.73
CREDITS.				
Expenditures:				
Provincial funds—				
Salaries	1,389,103.31		376.41	
Roads and bridges	477,229.56			
Construction and repair public buildings	157,401.82			
Contingent expense	1,024,283.18		97.79	
Maintenance of police, act No. 781	486.00			
Construction of wharf	1,764.55			
Purchase of land	5,819.15			
Moro—				
Salaries, educational	95,843.13			
Jolo wharf	23,856.57			
Zamboanga wharf	5,313.97			
Congressional relief funds—				
Salaries	313.66			
Roads and bridges	222,788.96			
Construction and repair of public buildings	25,267.02			
Contingent expenses	4,726.00			
Barrio schools	7,730.53			
Construction of pier, act No. 1406	5,502.74			
School assistance funds, act No. 797	4,279.57			
Tarlac dike, act No. 1406	6,662.75			
Tabaco-Ligao road, act No. 1260	48,327.57			
School buildings' funds	179,976.78			
School funds, act No. 1361	403.18			
Provincial government building, act No. 831	5,848.50			
Non-Christian inhabitants' funds	93.40			
Township and settlement funds	815.11			
Purchase of sailboat, act No. 1478	3,000.00			
Indang Naic road, act 1327	16,140.82			
Total expenditures	3,712,977.83		474.20	
Miscellaneous credits:				
Payments to municipalities		4,954,022.90		1,224.52
Exchanges of currency	259,269.05	3,595.19	454,483.13	5,146.61
Loans to municipalities	45,473.50			
Repayments loans—				
Insular	74,904.76			
Congressional relief	6,666.67			
Losses, section 41, act No. 1402	1,923.65		37.30	
Unapportioned internal revenue, act No. 1426		7,889.45		
Forestry refunds to municipalities erroneously charged provincial	2,419.25			
Appropriation subprovince of Catanduanes	777.49			
Congressional relief funds—Paid to province for construction of shools, act No. 1275	35,000.00			
All provincial—Deposit insular treasury, miscellaneous provincial revenue erroneously collected	3,461.60			
Refund of advances, act No. 799	2,625.02			
Total miscellaneous credits	432,520.99	4,965,507.54	454,520.43	6,371.13
Balance June 30, 1906	1,958,746.03	493,785.37	30,973.14	15.60
Total credits	6,104,244.85	5,459,292.91	485,967.77	6,386.73

OTHER FISCAL INFORMATION.

DISTRIBUTION OF INTERNAL-REVENUE COLLECTIONS.

The regular internal-revenue taxes assessed and collected under existing law are distributed as follows:

(1) To municipalities in which collected: License taxes on theaters, museums, cockpits, concert halls, pawnbrokers, circuses, and billiard rooms.

(2) To provinces and municipalities jointly: The poll or cedula tax, except in the case of the Moro Province, where the entire collection from the cedula tax accrues without division to the province.

(3) The collections from all other internal-revenue taxes are deposited in the insular treasury. Of this amount 75 per cent accrues to the insular government, and is deposited as insular revenue, and 25 per cent is deposited as refundable internal revenue and returned to the provinces, 10 per cent to be used for general provincial purposes and 15 per cent to be returned to the municipalities, of which latter sum one-third is devoted to municipal school purposes and the balance to general municipal purposes, except in the Moro Province, where the entire 25 per cent is devoted to general provincial purposes.

A special act (No. 1461) for the purpose of restricting the sale and use of opium until March 1, 1908, when its importation or use for any but medicinal purposes is forbidden by act of Congress, went into operation on April 1, 1906. The following taxes became due and were collected on and after that date: Chinese opium users' certificates of registration, annual license tax on wholesale and retail opium dealers, internal-revenue tax on opium in the islands when the law went into effect, on imports of opium, and on opium cooked and prepared in the islands. The taxes collected by virtue of this act are distributed as follows:

(1) To municipalities in which collected: Chinese opium users' certificates of registration, ₱5 each.

(2) To opium fund, act 1461: License tax on wholesale and retail dealers, internal-revenue tax on opium in the islands April 1, 1906, on imports of opium, and on the preparation of opium.

This special fund must be devoted solely to the following purposes:

(1) The printing and dissemination among the people of information as to the evils resulting from the use of opium.

(2) The payment of the reasonable expenses, in some reputable hospital, of those desiring to cure themselves of the opium habit.

(3) The payment of the expenses of such Filipino students as may be sent by the insular government to the United States for education.

(4) The payment of salaries of Filipinos who have been appointed insular teachers.

(5) The construction of schoolhouses and school buildings in the various municipalities of the islands: *Provided,* That 25 per centum of all fines imposed by reason of violations of this act shall be paid to the person who furnished the original evidence, and substantiated it, which led to the detection of the offense and the imposition of the fine. The name of the informer shall be specified in the judgment of the court when conviction is had in the court.

The refunds to the provinces and municipalities and to the city of Manila which, for this purpose, is considered both as a province and as a municipality, are made quarterly by settlement warrant upon the basis of their respective populations according to the census of 1903.

Internal-revenue collections for the fiscal years 1905 and 1906, and distribution of the proceeds, as provided by law and as above outlined, were as shown by the following tables·

Internal-revenue collections (comparative statement).

	Fiscal year—	
	1905.	1906.
CLASSIFICATION.		
Insular collections	₱3,998,422.00	₱6,841,032.24
Joint provincial and municipal (cedulas)	1,394,321.00	1,703,408.00
Municipal licenses	70,845.35	212,374.83
Opium fund, act No. 1461		53,206.28
Sale of opium certificates		27,000.00
Total	5,463,588.35	8,837,021.35
DISTRIBUTION.		
Amounts accruing to the insular government:		
75 per cent of insular collections	2,998,816.50	5,130,774.18
Opium fund created by act No. 1461		53,206.28
Amounts accruing to provinces:		
10 per cent of insular collections	399,842.20	684,103.22
One-half of cedula collections	697,160.50	851,704.00
Amounts accruing to municipalities:		
15 per cent of insular collections	599,763.30	1,026,154.84
One-half of cedula collections	697,160.50	851,704.00
Municipal licenses collections	70,845.35	212,374.83
Sale of opium-users' certificates		27,000.00
Total	5,463,588.35	8,837,021.35

Internal-revenue collections.

[Acts Nos. 1189 and 1461].

Provinces.	Insular.	Opium fund.	Cedulas.	Municipal licenses.	Opium users' certificates.	Total.
Albay	₱146,310.06	₱100.03	₱52,731.00	₱11,150.00	₱970.00	₱211,261.09
Ambos Camarines	123,577.27		54,038.00	6,961.00	45.00	184,621.27
Antique	3,181.89		24,448.00	516.00	255.00	28,400.89
Bataan	22,431.58		10,839.00	2,169.50		35,440.08
Batangas	26,560.00		65,197.00	4,107.50	185.00	96,049.50
Benguet	3,238.71		1,239.00	7.50		4,485.21
Bohol	9,627.39		52,998.00	5,395.50		68,020.89
Bulacan	323,197.63		58,574.00	4,447.50	165.00	386,384.13
Cagayan	73,750.32		39,101.00	9,283.49		122,134.81
Capiz	17,360.66	50.03	41,801.00	1,277,00	260.00	60,748.69
Cavite	22,968.53	.09	34,498.00	6,639.91	370.00	64,476.53
Cebu	131,512.76		110,200.00	15,739.00	15.00	257,466.76
Ilocos, Norte	12,111.45		40,306.00	1,132.50	140.00	53,689.95
Ilocos, Sur	62,526.50		57,650.00	5,481.00	150.00	125,807.50
Iloilo	132,803.78		95,743.00	10,212.00	945.00	239,703.78
Isabela	14,849.96	100.06	23,409.00	4,917.50	460.00	43,736.52
Laguna	73,240.51		41,368.00	4,917.50	160.00	119,686.01
Lepanto-Bontoc	406.10		13,455.00	400.00	10.00	14,271.10
Leyte	112,266.92	100.06	117,975.00	13,071.50	1,510.00	244,923.48
Masbate	4,322.15		982.00	105.00		5,409.15
Mindoro	5,486.89		10,313.00	955.00	45.00	16,799.89
Misamis	34,195.46		32,782.00	5,970.00	630.00	73,577.46
Moro	70,593.20	1,319.17	26,596.00	3,532.50	2,025.00	104,065.87
Nueva Ecija	16,693.48		33,146.00	3,226.50	160.00	53,225.98
Nueva Vizcaya	806.73		5,400.00	236.00		6,442.73
Occidental Negros	44,623.59	100.06	82,464.00	8,091.00	455.00	135,733.65
Oriental Negros	12,638.91		44,031.00	5,700.00	60.00	62,429.91
Palawan	3,510.46		5,618.00	155.00	10.00	9,293.46
Pampanga	174,409.30		48,215.00	4,229.50	400.00	227,253.80
Pangasinan	211,351.93	200.00	106,027.00	13,302.09	635.00	331,516.02
Rizal	51,294.89		38,801.00	14,492.50	275.00	104,863.39
Romblon	12,737.14	50.03	13,104.00	571.50	140.00	26,602.67
Samar	55,784.18		58,994.00	1,672.00		116,450.18
Sorsogon	69,607.48	250.15	38,720.00	10,695.00	720.00	119,992.63
Surigao	32,054.74	139.17	24,050.00	390.00	645.00	57,278.91
Tarlac	47,211.09		37,251.00	5,162.84	260.00	89,884.93
Tayabas	42,067.81		46,832.00	7,490.00	180.00	96,569.81
Union	15,560.07		31,339.00	2,860.00	35.00	49,794.07

Internal-revenue collections—Continued.

Provinces.	Insular.	Opium fund.	Cedulas.	Municipal licenses.	Opium users' certificates.	Total.
Zambales	₱10,048.20		₱14,035.00	₱1,445.00	₱90.00	₱25,618.20
City of Manila	4,616,594.59	₱50,797.43	69,138.00	14,267.50	14,595.00	4,765,392.52
Total gross collections	6,843,514.31	53,206.28	1,703,408.00	212,374.83	27,000.00	8,839,503.42
Erroneous collections refunded to taxpayers	2,482.07					2,482.07
Total net collections	6,841,032.24	53,206.28	1,703,408.00	212,374.83	27,000.00	8,837,021.35
DISTRIBUTION.						
Net insular revenue:						
75 per cent of insular collections	5,130,774.18					5,130,774.18
Collections accruing to the opium fund created by act No. 1461		53,206.28				53,206.28
Refundable to provinces:						
10 per cent of insular collections	684,103.22					684,103.22
One-half of cedula collectons			851,704.00			851,704.00
Refundable to municipalities:						
15 per cent of insular collections	1,026,154.84					1,026,154.84
One-half of cedula collections			851,704.00			851,704.00
Municipal license collections				212,374.83		212,374.83
Collections from sale of opium-users' certificates					27,000.00	27,000.00
Total	6,841,032.24	53,206.28	1,703,408.00	212,374.83	27,000.00	8,837,021.35

Table showing refunds of internal-revenue collections accruing to provinces and municipalities and amounts refunded during the fiscal year.

DEBIT.

Provinces.	Population, census 1903.	Balances July 1, 1905.		Refunds accruing during the fiscal year 1906.						Total.
				To provinces.		To municipalities.				
		Due provinces.	Due municipalities.	10 per cent of insular collections.	One-half of cedula collections.	15 per cent of insular collections.	One-half of cedula collections.	Municipal license collections.	Opium certificate collections.	
Albay	240,326	₱5,367.67	₱8,051.50	₱21,532.23	₱26,365.50	₱32,298.37	₱26,365.50	₱11,150.00	₱970.00	₱132,100.77
Ambos Camarines	239,405	5,347.10	8,020.64	21,449.72	27,019.00	32,174.57	27,019.00	6,961.00	45.00	128,036.03
Antique	134,166	2,996.59	4,494.89	12,020.74.	12,224.00	18,031.10	12,224.00	516.00	255.00	62,762.32
Bataan	46,787	1,044.98	1,567.48	4,191.92	5,419.50	6,287.89	5,419.50	2,169.50	....	26,100.77
Batangas	257,715	5,756.05	8,634.08	23,090.22	32,598.50	34,635.33	32,598.50	4,107.50	185.00	141,605.18
Benguet	22,745	508.01	762.01	2,037.85	619.50	3,056.80	619.50	7.50	....	7,611.17
Bohol	269,223	6,013.08	9,019.62	24,121.29	26,499.00	36,181.92	26,499.00	5,395.50	....	133,729.41
Bulacan	223,742	4,997.26	7,495.90	20,046.37	29,287.00	30,069.57	29,287.00	4,447.50	165.00	125,795.60
Cagayan	156,239	3,489.59	5,234.38	13,998.38	19,550.50	20,997.58	19,550.50	9,283.49	....	92,104.42
Capiz	230,721	5,153.14	7,729.71	20,671.66	20,900.50	31,007.49	20,900.50	1,277.00	260.00	107,900.00
Cavite	134,779	3,010.28	4,515.42	12,075.66	17,249.00	18,113.48	17,249.00	6,639.91	370.00	79,222.75
Cebu	653,727	14,600.96	21,901.43	58,571.30	55,100.00	87,856.93	55,100.00	15,739.00	15.00	308,884.62
Ilocos Norte	178,995	3,997.84	5,996.77	16,037.23	20,153.00	24,055.84	20,153.00	1,132.50	140.00	91,666.18
Ilocos Sur	239,271	5,344.10	8,016.16	21,437.71	28,825.00	32,156,58	28,825.00	5,481.00	150.00	130,235.55
Iloilo	410,315	9,164.36	13,746.55	36,762.57	47,871.50	55,143.82	47,871.50	10,212.00	945.00	221,717.30
Isabela	76,431	1,707.08	2,560.63	6,847.90	11,704.50	10,271.86	11,704.50	4,917.50	460.00	50,173.97
Laguna	148,606	3,319.11	4,978.66	13,314.51	20,684.00	19,971.73	20,684.00	4,917.50	160.00	88,029.51
Lepanto-Bontoc	72,750	1,624.87	2,437.30	6,518.11	6,727.50	9,777.17	6,727.50	400.00	10.00	34,222.45
Leyte	388,922	8,686.55	13,029.83	34,845.84	58,987.50	52,268.75	58,987.50	13,071.50	1,510.00	241,387.47
Masbate	43,675	975.48	1,463,22	968.28	491.00	1,452.42	491.00	105.00	....	5,946.40
Mindoro	39,582	884.06	1,326.09	3,546.39	5,156.50	5,319.57	5,156.50	955.00	45.00	22,389.11
Misamis	154,074	3,859.72	5,789.59	14,219.81	16,391.00	21,329.71	16,391.00	5,970.00	630.00	84,580.83
Moro [a]	401,777	8,555.18	12,832.76	35,582.19	13,298.00	53,373.29	13,298.00	3,532.50	2,025.00	142,496.92
Nueva Ecija	134,147	2,996.17	4,494.25	12,019.03	16,573.00	18.028.54	16,573.00	3,226.50	160.00	74,070.49
Nueva Vizcaya	62,541	1,396.85	2,095.28	5,603.41	2,700.00	8,405.15	2,700.00	236.00	....	23,136.69
Occidental Negros	308,272	6,885.24	10,327.86	27,619.92	41,232.00	41,429.89	41,232.00	8,091.00	455.00	177,272.91
Oriental Negros	201,494	4,500.36	6,750.53	18,053.05	22,015.50	27,079.56	22,015.50	5,700.00	60.00	106,174.50
Palawan	35,696	797.27	1,195.90	3,198.21	2,809.00	4,797.32	2,809.00	155.00	10.00	15,771.70
Pampanga	223,754	4,997.53	7,496.30	20,047.45	24,107.50	30,071.19	24,107.50	4,229.50	400.00	115,456.97
Pangasinan	442,521	9,883.68	14,825.52	39,648.08	53,013.50	59,472.12	53,013.50	13,302.09	635.00	243,793.49
Rizal	150,923	3,370.86	5,056.28	13,522.09	19,400.50	20,283.13	19,400.50	14,492.50	275.00	95,800.86
Romblon	52,848	1,180.36	1,770.53	4,734.97	6,552.00	7,102.45	6,552.00	571.50	140.00	28,603.81
Samar	266,237	5,946.39	8,919.58	23,853.76	29,497.00	35,780.64	29,497.00	1,672.00	....	135,166.37
Sorsogon	120,495	2,691.25	4,036.88	13,740.69	19,360.00	20,611.04	19,360.00	10,695.00	720.00	91,214.86

[a] In the case of the Moro Province the entire 25 per cent of insular collections and the whole amount of the cedula collections accrue to the provincial treasury without division.

Table showing refunds of internal-revenue collections accruing to provinces and municipalities and amounts refunded during the fiscal year—Cont'd.

DEBIT—Continued.

Provinces.	Population, census 1903.	Balances July 1, 1905.		Refunds accruing during the fiscal year 1906.						Total.
				To provinces.		To municipalities.				
		Due provinces.	Due municipalities.	10 per cent of insular collections.	One-half of cedula collections.	15 per cent of insular collections.	One-half of cedula collections.	Municipal license collections.	Opium certificate collections.	
Surigao	114,982	₱2,568.12	₱3,852.17	₱10,301.90	₱12,025.00	₱15,452.89	₱12,025.00	₱390.00	₱645.00	₱57,260.08
Tarlac	135,107	3,017.65	4,526.47	12,105.03	18,625.50	18.157.56	18,625.50	5,162.84	260.00	80,480.55
Tayabas	204,739	4,572.83	6,859.25	18,343.78	23,416.00	27,515.68	23,416.00	7,490.00	180.00	111,793.54
Union	137,839	3,078.63	4,617.94	12,349.82	15,669.50	18,524.71	15,669.50	2,860.00	35.00	72,805.10
Zambales	59,930	1,338.53	2,007.80	5,369.49	7,017.50	8,054.22	7,017.50	1,445.00	90.00	32,340.04
City of Manila[a]	219,928	14,626.08	18,654.62	19,704.66	34,569.00	29,556.98	34,569.00	14,267.50	14,595.00	180,542.84
Total	7,635,426	180,250.86	267,091.78	684,103.22	851,704.00	1,026,154.84	851,704.00	212,374.83	27,000.00	4,100,383.53

CREDIT.

Provinces.	Refunded to provinces.		Refunded to municipalities.				Balance due provinces June 30, 1906.	Balance due municipalities June 30, 1906.	Total.
	10 per cent of insular collections.	One-half of cedula collections.	15 per cent of insular collections.	One-half of cedula collections.	Municipal license collections.	Opium certificate collections.			
Albay	₱26,042.77	₱26,365.50	₱32,363.95	₱26,365.50	₱11,150.00	₱970.00	₱857.13	₱7,985.92	₱132,100.77
Ambos Camarines	21,433.28	27,019.00	32,239.90	27,019.00	6,961.00	45.00	5,363.54	7,955.31	128,036.03
Antique	11,740.65	12,224.00	18,067.72	12,224.00	516.00	255.00	3,276.68	4,458.27	62,762.32
Bataan	2,967.28	5,419.50	6,300.66	5,419.50	2,169.50	....	2,269.62	1,554.71	26,100.77
Batangas	6,185.41	32,598.50	34,705.67	32,598.50	4,107.50	185.00	22,660.86	8,563.74	141,605.18
Benguet	2,041.99	619.50	3,063.00	619.50	7.50	....	503.87	755.81	7,611.17
Bohol	22,889.16	26,499.00	36,255.40	26,499.00	5,395.50	....	7,245.21	8,946.14	133,729.41
Bulacan	14,059.46	29.287.00	30,130.64	29,287.00	4,447.50	165.00	10,984.17	7,434.83	125,795.60
Cagayan	10,401.23	19,550.50	21,040.21	19,550.50	9,283.49	....	7,086.74	5,191.75	92,104.42
Capiz	20,713.64	20,900.50	31,070.46	20,900.50	1,277.00	260.00	5,111.16	7,666.74	107,900.00
Cavite	8,656.35	17,249.00	18,150.26	17,249.00	6,639.91	370.00	6,429.59	4,478.64	79,222.75
Cebu	57,573.67	55,100.00	88,035.34	55,100.00	15,739.00	15.00	15,598.59	21,723.02	308,884.62
Ilocos Norte	8,533.79	20,153.00	24,104.70	20,153.00	1,132.50	140.00	11,501.28	5,947.91	91,666.18
Ilocos Sur	15,458.40	28,825.00	32,221.88	28,825.00	5,481.00	150.00	11,323.41	7,950.86	130,235.55
Iloilo	37,873.41	47,871.50	55,255.81	47,871.50	10,212.00	945.00	8,053.52	13,634.56	221,717.30

Isabela	4,533.78	11,704.50	10,292.73	11,704.50	4,917.50	460.00	4,021.20	2,539.76	50,173.97
Laguna	6,613.73	20,684.00	20,012.29	20,684.00	4,917.50	160.00	10,019.89	4,938.10	88,029.51
Lepanto-Bontoc	6,262.27	6,727.50	9,797.02	6,727.50	400.00	10.00	1,880.71	2,417.45	34,222.45
Leyte	25,006.66	58,987.50	52,374.90	58,987.50	13,071.50	1,510.00	18,525.73	12,923.68	241,387.47
Masbate	1,943.76	491.00	2,915.64	491.00	105.00	....	....	....	5,946.40
Mindoro	3,547.59	5,156.50	5,330.37	5,156.50	955.00	45.00	882.86	1,315.29	22,389.11
Misamis	5,798.62	16,391.00	21,999.50	16,391.00	5,970.00	630.00	12,280.91	5,119.80	84,580.83
Moro [b]	32,022.58	13,298.00	48,033.87	13,298.00	3,532.50	2,025.00	12,114.79	18,172.18	142,496.92
Nueva Ecija	7,751.26	16,573.00	18,065.15	16,573.00	3,226.50	160.00	7,263.94	4,457.64	74,070.49
Nueva Vizcaya	5,614.79	2,700.00	8,422.22	2,700.00	236.00	....	1,385.47	2,078.21	23,136.69
Occidental Negros	27,651.01	41,232.00	41,514.03	41,232.00	8,091.00	455.00	6,854.15	10,243.72	177,272.91
Oriental Negros	17,350.82	22,015.50	27,134.55	22,015.50	5,700.00	60.00	5,202.59	6,695.54	106,174.50
Palawan	2,376.37	2,809.00	4,807.06	2,809.00	155.00	10.00	1,619.11	1,186.16	15,771.70
Pampanga	20,088.16	24,107.50	30,132.25	24,107.50	4,229.50	400.00	4,956.82	7,435.24	115,456.97
Pangasinan	39,728.60	53,013.50	59,592.89	53,013.50	13,302.09	635.00	9,803.16	14,704.75	243,793.49
Rizal	13,549.55	19,400.50	20,324,32	19,400.50	14,492.50	275.00	3,343.40	5,015.09	95,800.86
Romblon	4,185.60	6,552.00	7,116.87	6,552.00	571.50	140.00	1,729.73	1,756.11	28,603.81
Samar	17,724.08	29,497.00	35,853.30	29,497.00	1,672.00	....	12,076.07	8,846.92	135,166.37
Sorsogon	8,985.46	19,360.00	19,192.63	19,360.00	10,695.00	720.00	7,446.48	5,455.29	91,214.86
Surigao	7,654.64	12,025.00	15,484.26	12,025.00	390.00	645.00	5,215.38	3,820.80	57,260.08
Tarlac	11,310.34	18,625.50	18,194.49	18,625.50	5,162.84	260.00	3,812.34	4,489.54	80,480.55
Tayabas	9,111.92	23,416.00	27,571.55	23,416.00	7,490.00	180.00	13,804.69	6,803,38	111,793.54
Union	9,176.30	15,669.50	18,562.33	15,669.50	2,860.00	35.00	6,252.15	4,580.32	72,805.10
Zambales	6,421,14	7,017.50	8,070.58	7,017.50	1,445.00	90.00	286.88	1,991.44	32,340.04
City of Manila [a]	14,641.17	13,614.50	21,961.76	13,614.50	11,045.00	....	40,644.07	65,021.84	180,542.84
Total	575,620.69	830,749.50	1,015,762.16	830,749.50	209,152.33	12,405.00	309,687.89	316,256.46	4,100,383.53

[a] For the purposes of the refund of internal-revenue collections the city of Manila is considered both as a province and as a municipality.

[b] In the case of the Moro Province the entire 25 per cent of insular collections and the whole amount of the cedula collections accrue to the provincial treasury without division.

COMPARISON OF COLLECTIONS MADE UNDER THE INTERNAL-REVENUE LAW WITH COLLECTIONS MADE UNDER THE FORMER SYSTEM.

For the purpose of comparing the collections made under the internal-revenue law of 1904 with the collections from taxes which were replaced by said law, two tables are given below, which show the collections made in the last complete fiscal year under the old system, and the first complete fiscal year under the new system. The first table shows the collections accruing to the provincial governments under both systems; the second table shows the collections accruing to the municipalities of each province under the two systems. It should be noted that under the old system no part of the collections accrued to the insular government, while under the new internal-revenue law 75 per cent of the internal-revenue collections, exclusive of cedula taxes, license fees, and proceeds of opium-users' certificates, accrues as insular revenue and 25 per cent is refunded to the provinces and municipalities, and is known as refundable internal revenue. The general results of the two tables of comparison may be briefly summarized as follows:

Collections made under the old system, fiscal year 1904, and which accrued to provinces and municipalities.

	Provinces.	Municipalities (excluding Manila).
Industrial	₱614,038.14	₱573,930.80
Cedula	727,749.30	696,365.22
Stamp	33,939.95	32,259.94
Forestry refund	159,470.24	121,813.85
Total collections, old system	1,535,197.63	1,424,369.81

Internal revenues, acts Nos. 1189 and 1461, fiscal year 1906, which accrued to the insular government, provinces, and municipalities.

	Insular government.	Provinces.	Municipalities (excluding Manila).
Insular internal revenue	₱5,130,774.18	₱717,771.85	₱943,224.57
Insular opium fund	53,206.28		
Cedulas		830,433.00	803,837.00
Municipal licenses			198,107.33
Opium-users' certificates			12,405.00
Total, present system	5,183,980.46	1,548,204.85	1,957,573.90
Total, old system		1,535,197.63	1,424,369.81
Increase under the new system	5,183,980.46	13,007.22	533,204.09

THE CITY OF MANILA.

Collections accruing under the old system, fiscal year 1904:		
Industrial	₱613,061.27	
Cedula	92,704.00	
Stamp	167,653.00	
		₱873,418.27
Collections accruing under the new system, fiscal year 1904:		
Refundable internal revenue	49,261.64	
Cedula	69,138.00	
Municipal licenses	14,267.50	
Opium-users' certificates	14,595.00	
		147,262.14
Decrease to the city of Manila under the new system		726,156.13

Increases of revenue under the new taxes over the revenues derived from the old taxes:	
To insular government	5,183,980.46
To provinces	13,007.22
To municipalities (excluding Manila)	533,204.09
Total increase	5,730,191.77
Decrease to the city of Manila	726,156.13
Net increase under the new system	5,004,035.64

Comparative statement showing revenues accruing to provinces under former system of taxation and under the internal-revenue law of 1904.

Province.	Population, census 1903, excluding Manila.	Provincial revenues, fiscal year 1904.					Provincial revenues, fiscal year 1906 (Act No. 1189).		
		One-half industrial.	One-half cedula.	One-half stamp.	One-half forestry refunds.	Total.	10 per cent refundable, including forestry	One-half cedulas.	Total.
Albay	240,326	₱39,312.95	₱22,611.53	₱1,256.27	₱1,936.17	₱65,116.92	₱21,532.23	₱26,365.50	₱47,897.73
Ambos Camarines	239,405	21,565.96	16,380.00	762.26	7,483.67	46,191.89	21,449.72	27,019.00	48,468.72
Antique	134,166	2,943.99	6,748.31	232.83	256.69	10,181.82	12,020.74	12,224.00	24,244.74
Bataan	46,787	3,864.89	5,737.29	167.80	6,917.51	16,687.49	4,191.92	5,419.50	9,611.42
Batangas	257,715	11,180.11	34,138.34	648.09	641.85	46,608.39	23,090.22	32,598.50	55,688.72
Benguet	22,745	....	....	....	....	....	2,037.85	619.50	2,657.35
Bohol	269,223	8,269.45	23,936.10	686.77	998.90	33,891.22	24,121.29	26,499.00	50,620.29
Bulacan	223,742	33,962.88	22,355.73	619.31	3,449.06	60,386.98	20,046.37	29,287.00	49,333.37
Cagayan	156,239	20,596.70	17,745.77	425.61	5,035.32	43,803.40	13,998.38	19,550.50	33,548.88
Capiz	230,721	9,669.80	16,573.01	623.78	861.89	27,728.48	20,671.66	20,900.50	41,572.16
Cavite	134,779	6,199.16	19,905.09	918.36	511.21	27,533.82	12,075.66	17,249.00	29,324.66
Cebu	653,727	30,705.12	63,485.24	2,056.90	760.75	97,008.01	58,571.30	55,100.00	113,671.30
Ilocos Norte	178,995	5,071.69	17,377.70	593.69	1,577.95	24,621.03	16,037.23	20,153.00	36,190.23
Ilocos Sur	239,271	12,171.02	23,722.96	460.91	2,531.22	38,886.11	21,437.71	28,825.00	50,262.71
Iloilo	410,315	32,757.96	48,284.28	6,000.98	5,844.25	92,887.47	36,762.57	47,871.50	84,634.07
Isabela	76,431	11,477.46	8,298.17	171.58	1,761.98	21,709.19	6,847.90	11,704.50	18,552.40
Laguna	148,606	17,201.97	17,362.36	432.14	1,659.98	36,656.45	13,314.51	20,684.00	33,998.51
Lepanto-Bontoc	72,750	191.24	....	9.34	2.71	203.29	6,518.11	6,727.50	13,245.61
Leyte	388,922	53,799.66	47,343.55	1,000.99	2,869.89	105,014.09	34,845.84	58,987.50	93,833.34
Masbate	43,675	5,234.06	2,932.69	82.94	7,710.58	15,960.27	968.28	491.00	1,459.28
Mindoro	39,582	3,117.98	....	1,465.64	4,612.23	9,195.85	3,546.39	5,156.50	8,702.89
Misamis	154,074	15,326.77	17,143.85	248.30	765.17	33,484.09	14,219.81	16,391.00	30,610.81
Moro	401,777	40,107.32	31,384.10	1,680.01	37,656.39	110,827.82	88,955.48	26,596.00	115,551.48
Nueva Ecija	134,147	4,845.31	15,286.47	126.01	2,561.27	22,819.06	12,019.03	16,573.00	28,592.03
Nueva Vizcaya	62,541	431.49	....	46.60	....	478.09	5,603.41	2,700.00	8,303.41
Occidental Negros	308,272	11,864.93	25,103.18	848.81	6,072.34	43,889.26	27,619.92	41,232.00	68,851.92
Oriental Negros	201,494	6,906.70	18,997.34	414.56	1,257.03	27,575.63	18,053.05	22,015.50	40,068.55
Palawan	35,696	2,081.24	....	154.77	3,721.43	5,957.44	3,198.21	2,809.00	6,007.21
Pampanga	223,754	16,660.64	14,108.64	220.11	4,287.26	35,276.65	20,047.45	24,107.50	44,154.95
Pangasinan	442,521	25,327.79	52,229.19	1,902.93	2,864.41	82,324.32	39,648.08	53,013.50	92,661 58
Rizal	150,923	13,790.19	20,949.43	775.74	1,815.88	37,331.24	13,522.09	19,400.50	32,922.59
Romblon	52,848	11,524.44	6,270.73	212.55	771.68	18,779.40	4,734.97	6,552.00	11,286.97
Samar	266,237	38,366.65	23,787.49	1,018.43	965.62	64,138.19	23,853.76	29,497.00	53,350.76
Sorsogon	120,495	34,942.66	18,121.59	3,804.96	1,924.26	58,793.47	13,740.69	19,360.00	33,100.69
Surigao	114,982	10,249.01	13,607.63	333.47	786.29	24,976.40	10,301.90	12,025.00	22,326.90
Tarlac	135,107	14,104.99	15,863.29	1,578.22	5,032.39	36,578.89	12,105.03	18,625.50	30,730.53
Tayabas	204,739	19,508.21	21,917.86	1,441.87	25,028.27	67,896.21	18,343.78	23,416.00	41,759.78
Union	137,839	15,992.39	11,678.30	375.25	906.72	28,952.66	12,349.82	15,669.50	28,019.32
Zambales	59,930	2,713.36	6,362.09	141.17	5,630.02	14,846.64	5,369.49	7,017.50	12,386.99
Total	7,415,498	614,038.14	727,749 30	33,939.95	159,470.24	1,535,197.63	717,771.85	830,433.00	1,548,204.85

Comparative statement showing revenues accruing to municipalities under former system of taxation and under the internal-revenue law of 1904.

Provinces.	Population, census of 1903.	Municipal revenues for fiscal year 1904, former system.					Municipal revenues for fiscal year 1906 (act No. 1189).				
		One-half industrial.	One-half cedula.	One-half stamp.	One-half forestry refunds.	Total.	15 per cent refundable including forestry.	One-half cedulas.	Municipal licenses.	Opium-users' certificates.	Total.
Albay	240,326	₱39,312.95	₱22,611.53	₱1,256.27	₱1,936.17	₱65,116.92	₱32,298.37	₱26,365.50	₱11,150.00	₱970.00	₱70,783.87
Ambos Camarines	239,405	21,565.96	16,380.00	762.26	7,483.67	46,191.89	32,174.57	27,019.00	6,961.00	45.00	66,199.57
Antique	134,166	2,943.99	6,748.31	232.83	256.69	10,181.82	18,031.10	12,224.00	516.00	255.00	31,026.10
Bataan	46,787	3,864.89	5,737.29	167.80	6,917.51	16,687.49	6,287.89	5,419.50	2,169.50		13,876.89
Batangas	257,715	11,180.11	34,138.34	648.09	641.85	46,608.39	34,635.33	32,598.50	4,107.50	185.00	71,526.33
Benguet	22,745						3,056.80	619.50	7.50		3,683.80
Bohol	269,223	8,269.45	23,936.10	686.77	998.90	33,891.22	36,181.92	26,499.00	5,395.50		68,076.42
Bulacan	223,742	33,962.88	22,355.73	619.31	3,449.06	60,386.98	30,069.57	29,287.00	4,447.50	165.00	63,969.07
Cagayan	156,239	20,596.70	17,745.77	425.61	5,035.32	43,803.40	20,997.58	19,550.50	9,283.49		49,831.57
Capiz	230,721	9,669.80	16,573.01	623.78	861.89	27,728.48	31,007.49	20,900.50	1,277.00	260.00	53,444.99
Cavite	134,779	6,199.16	19,905.09	918.36	511.21	27,533.82	18,113.48	17,249.00	6,639.91	370.00	42,372.39
Cebu	653,727	30,705.12	63,485.24	2,056.90	760.75	97,008.01	87,856.93	55,100.00	15,739.00	15.00	158,710.93
Ilocos Norte	178,995	5,071.69	17,377.70	593.69	1,577.95	24,621.03	24,055.84	20,153.00	1,132.50	140.00	45,481.34
Ilocos Sur	239,271	12,171.02	23,722.96	460.91	2,531.22	38,886.11	32,156.58	28,825.00	5,481.00	150.00	66,612.58
Iloilo	410,315	32,757.96	48,284.28	6,000.98	5,844.25	92,887.47	55,143.82	47,871.50	10,212.00	945.00	114,172.32
Isabela	76,431	11,477.46	8,298.17	171.58	1,761.98	21,709.19	10,271.86	11,704.50	4,917.50	460.00	27,353.86
Laguna	148,606	17,201.97	17,362.36	432.14	1,659.98	36,656.45	19,971.73	20,684.00	4,917.50	160.00	45,733.23
Lepanto-Bontoc	72,750	191.24		9.34	2.71	203.29	9,777.17	6,727.50	400.00	10.00	16,914.67
Leyte	388,922	53,799.66	47,343.55	1,000.99	2,869.89	105,014.09	52,268.75	58,987.50	13,071.50	1,510.00	125,837.75
Masbate	43,675	5,234.06	2,932.69	82.94	7,710.58	15,960.27	1,452.42	491.00	105.00		2,048.42
Mindoro	39,582	3,117.98		1,465.64	4,612.23	9,195.85	5,319.57	5,156.50	955.00	45.00	11,476.07
Misamis	154,074	15,326.77	17,143.85	248.30	765.17	33,484.09	21,329.71	16,391.00	5,970.00	630.00	44,320.71
Moro	401,777								3,532.50	2,025.00	5,557.50
Nueva Ecija	134,147	4,845.31	15,286.47	126.01	2,561.27	22,819.06	18,028.54	16,573.00	3,226.50	160.00	37,988.04
Nueva Vizcaya	62,541	431.49		46.60		478.09	8,405.15	2,700.00	236.00		11,341.15
Occidental Negros	308,272	11,864.93	25,103.18	848.81	6,072.34	43,889.26	41,429.89	41,232.00	8,091.00	455.00	91,207.89
Oriental Negros	201,494	6,906.70	18,997.34	414.56	1,257.03	27,575.63	27,079.56	22,015.50	5,700.00	60.00	54,855.06
Palawan	35,696	2,081.24		154.77	3,721.43	5,957.44	4,797.32	2,809.00	155.00	10.00	7,771.32
Pampanga	223,754	16,660.64	14,108.64	220.11	4,287.26	35,276.65	30,071.19	24,107.50	4,229.50	400.00	58,808.19
Pangasinan	442,521	25,327.79	52,229.19	1,902.93	2,864.41	82,324.32	59,472.12	53,013.50	13,302.09	635.00	126,422.71
Rizal	150,923	13,790.19	20,949.43	775.74	1,815.88	37,331.24	20,283.13	19,400.50	14,492.50	275.00	54,451.13
Romblon	52,848	11,524.44	6,270.73	212.55	771.68	18,779.40	7,102.45	6,552.00	571.50	140.00	14,365.95
Samar	266,237	38,366.65	23,787.49	1,018.43	965.62	64,138.19	35,780.64	29,497.00	1,672.00		66,949.64
Sorsogon	120,495	34,942.66	18,121.59	3,804.96	1,924.26	58,[illegible]47	20,611.04	19,360.00	10,695.00	720.00	51,386.04
Surigao	114,982	10,249.01	13,607.63	333.47	786.29	24,976.40	15,452.89	12,025.00	390.00	645.00	28,512.89
Tarlac	135,107	14,104.99	15,863.29	1,578.22	5,032.39	36,578.89	18,157.56	18,625.50	5,162.84	260.00	42,205.90
Tayabas	204,739	19,508.21	21,917.86	1,441.87	25,028.27	67,896.21	27,515.68	23,416.00	7,490.00	180.00	58,601.68
Union	137,839	15,992.39	11,678.30	375.25	906.72	28,952.66	18,524.71	15,669.50	2,860.00	35.00	37,089.21
Zambales	59,930	2,713.36	6,362.09	141.17	5,630.02	14,846.64	8,054.22	7,017.50	1,445.00	90.00	16,606.72
Total	7,415,498	573,930.82	696,365.20	32,259.94	121,813.85	1,424,369.81	943,224.57	803,837.00	198,107.33	12,405.00	1,957,573.90
City of Manila	219,928	613,061.27	92,704.00	167,653.00		873,418.27	49,261.64	69,138.00	14,267.50	14,595.00	147,262.14
Grand total	7,635,426	1,186,992.09	789,069.20	199,912.94	121,813.85	2,297,788.08	992,486.21	872,975.00	212,374.83	27,000.00	2,104,836.04

In the case of some provinces the diminution of provincial and municipal revenues under the new system of taxation is accounted for by the fact that such provinces export large quantities of forestry products, and under the old system the taxes on such products, regardless of where collected, were, after the expenses of the bureau of forestry had been deducted, returned to the province from which the products were taken to be equally divided between the province and the municipalities where the products originated. Under the internal-revenue law of 1904 the collections from forestry products are included in insular collections of internal revenue, only 25 per cent of which is returned to the provinces and municipalities in proportion to their population.

In other provinces the diminution of provincial and municipal revenues is due to the fact that formerly a large revenue was derived from the industrial tax in proportion to the respective populations of such provinces. Some provinces which have small populations, upon which the present internal-revenue refunds are based, but in which there is a large amount of business transacted in proportion to the population, formerly derived large revenues from the industrial tax, and have consequently suffered a decrease under the present system, where the internal-revenue refunds are based on population. The converse of this is likewise true, provinces which have large populations but whose revenues from the industrial tax were comparatively small on account of less business activity make substantial gains in revenue under the present system.

SURETY BONDS.

Under existing law practically every officer of the government who is accountable or responsible for money or property, whether insular, provincial, or municipal, is placed under bond with the American Surety Company of New York and the Fidelity and Deposit Company of Maryland, joint official sureties under contract with the insular government. The duty of fixing the amounts of these bonds and retaining them in custody and the collection and payment of premiums thereon were placed under the jurisdiction of the auditor from January 1, 1906, the beginning of a contract year with the official sureties. The present contract provides for the payment of an annual premium of 1 per cent of the amount of each bond. The full amount of these premiums are paid, as provided by law, from a special reimbursable appropriation, and thereafter one-third of 1 per cent is collected from the person bonded, and the remaining two-thirds of 1 per cent is paid by the insular government, or the province or municipality on behalf of which the officer bonded is serving, except in cases otherwise provided for by the Commission.

The bond schedule was completely revised at the outset with a view to fixing bonds in amounts proportionate to the responsibility involved, as determined by the previous experience of this office. Bonds now range in amount from ₱300 for postmasters at small offices to ₱500 at other small post-offices, where the postmaster is also the telegraph operator, to ₱10,000 at large money-order post-offices. Provincial treasurers are bonded in amounts from ₱10,000 in Lepanto-Bontoc to ₱100,000 in the Moro Province, while sheriffs are bonded in amounts from ₱5,000 to ₱12,000, and insular collecting and disbursing officers in amounts from ₱1,000 to ₱50,000. The insular treasurer is bonded for ₱200,000 and the assistant treasurer ₱100,000.

Following is a statement of the surety business for the calendar year 1906 to June 30, not including the bond of the insular treasurer, which is special:

Total number of entries on schedule for 1906, 1,851, amounting to...	₱7, 332, 700. 00
Average amount of each bond executed on January 1, 1906..........	3, 961. 48
Number of bonds executed to June 30, 1906, 2,425, amounting to....	₱10, 772, 700. 00
Number of entries deducted to June 30, 1906, 478, amounting to.....	3, 135, 600. 00
Number of bonds remaining in force June 30, 1906, 1,947, amounting to..	7, 637, 100. 00
Average amount of each bond in force on June 30, 1906......	3, 922. 50

For purposes of comparison the record for the calendar year 1905 is appended:

Total number of entries on schedule for 1905, 1,631, amounting to....	₱9, 484, 600. 00
Average amount of each bond executed on January 1, 1905........	5, 815. 21
Number of bonds executed to June 30, 1905, 2,086, amounting to....	12, 256, 400. 00
Number of entries deducted to June 30, 1905, 384, amounting to....	2, 805, 200. 00
Number of bonds remaining in force June 30, 1905, 1,702, amounting to..	9, 451, 200. 00
Average amount of each bond in force on June 30, 1905......	5, 553. 00

Notwithstanding there was an increase of 220 in the number of persons placed under bond on January 1, 1906, as compared with January 1, 1905, there was a decrease of ₱2,151,900 in the total amount of the bonds executed, resulting in a saving to the government and the persons bonded of ₱21,519. It is not believed that these reductions in bonds will result in any loss to the government.

PAYMENTS OF SHORTAGES BY SURETIES.

The following payments were made during the fiscal year 1906 by the official surety companies on account of shortages of insular, joint insular and provincial, and joint provincial and municipal shortages. With the exception of the cases of Hugh S. Breszee, supply officer, and E. H. Yost, cashier, bureau of cold storage, all of the shortages of insular and joint insular and provincial officers occurred in prior fiscal years:

Insular.

Hugh S. Breszee, supply officer, Philippines Constabulary, Malolos, Bulacan	₱2, 989. 90
Isidor Gintzler, supply officer, Philippines Constabulary, Cebu, Cebu	181. 20
Francis N. Fountain, supply officer, Philippines Constabulary, Dagupan, Pangasinan	1, 190. 10
J. H. Hazeltine, commissary officer, Benguet road	1, 175. 08
E. H. Yost, cashier, bureau of cold storage	5, 030. 82
Elmer B. Melton, supply officer, Philippines Constabulary, Baguio, Benguet	2, 769. 70
Total	13, 336. 80

Insular and provincial.

F. Dean Tompkins, treasurer, province of Union	₱6, 991. 52
Wm. Geo. Hollis, treasurer, province of Negros Occidental	9, 609. 28
Reuel E. Sherwood, treasurer, province of Masbate	447. 68
Total	17, 048. 48

Provincial and municipal.

Domingo C. Acosta, municipal treasurer and deputy provincial treasurer, Moron, Bataan	₱1, 481. 78
Tranquilino Benigno, municipal treasurer and deputy provincial treasurer, Angadanan, Isabela	152. 70
Espiridion Limson, municipal treasurer and deputy provincial treasurer, Cauayan, Negros Occidental	722. 48
Juan Peñalosa, municipal treasurer and deputy provincial treasurer, Talisay, Cebu	352. 54
Francisco Acuña, municipal treasurer and deputy provincial treasurer, Legaspi, Albay	3, 067. 86
Emilio Agapay, municipal treasurer and deputy provincial treasurer, Tinambac, Ambos Camarines	845. 58
Ismael Tabotabo, municipal treasurer and deputy provincial treasurer, Tuburan, Cebu	3, 614. 24
Pedro Barros, municipal treasurer and deputy provincial treasurer, Lopez, Tayabas	3, 528. 48
Moises Abueg, municipal treasurer and deputy provincial treasurer, Subig, Zambales	1, 955. 52
Juan Rosales, municipal treasurer and deputy provincial treasurer, Dumalag, Capiz	558. 32
Modesto Garcia, municipal treasurer and deputy provincial treasurer, Caybiran, Leyte	1,862. 14
Jose C. Juarez, municipal treasurer and deputy provincial treasurer, Talisay, Negros Occidental	488. 36
Jorge Plumaje, municipal treasurer and deputy provincial treasurer, San Carlos, Negros Occidental	357. 86
Cayetano H. Cuevas, municipal treasurer and deputy provincial treasurer, Ayuquitan, Negros Oriental	466. 58
Total	19, 454. 44

Includes interest and court costs of ₱189. 34.

Summary of shortages paid during fiscal year ending June 30, 1906:

6 insular officers	₱13,336.80
3 insular and provincial officers	17,048.48
14 provincial and municipal officers	19,454.44
Grand total	49,839.72

PROPERTY ACCOUNTABILITY.

This report deals essentially with money accountability, but as the work of the auditor comprehends property accountability as well, the following brief report of the work of the property division is submitted.

Demands were made on the official surety companies during the fiscal year 1906 on account of property shortages, as follows:

Lauritz Karboling, late quartermaster, bureau of constabulary	₱827.71
A. H. Matthews, late supply officer, bureau of constabulary, Iloilo	8,204.55
C. A. Thorp, late supply officer, bureau of constabulary, Samar	440.50
John Arthur, late supply officer, bureau of constabulary	471.50
Chas. E. Borden, late supply officer, bureau of constabulary	1,893.88
L. C. Dean, late supply officer, bureau of constabulary	2,616.08
Guy C. Foote, late supply officer, bureau of constabulary	291.93
M. H. Burnham, late supply officer, bureau of constabulary	1,233.62
E. R. Knapp, late supply officer, bureau of constabulary	327.95
A. F. Perry, late supply officer, bureau of constabulary	480.25
John A. Strain, late supply officer, bureau of constabulary	2,183.72
Total	18,971.69

Included in the amounts paid by the official surety companies during the fiscal year 1906 were property shortages as follows:		
On account of E. B. Melton, late supply officer, Philippines constabulary	₱1,894.76	
On account of Francis N. Fountain, late supply officer, Philippines constabulary	1,190.10	
On account of Isidor Gintzler, late supply officer, Philippines constabulary	181.20	
On account of Dean F. Tompkins, late provincial treasurer	27.50	
		₱3,293.56
Other collections on account of property shortages were made in accordance with sections 4 and 6, act No. 215, as follows:		
From 50 insular officers	4,901.68	
From 2 provincial officers	108.00	
		5,009.68
Grand total of collections		8,303.24

Property was dropped on inspection reports approved by the governor-general, as follows:

L. A. Porter (deceased), supply officer, bureau of constabulary	1,285.87
C. D. Lovejoy (deceased), quartermaster, bureau of constabulary	1,119.95
John Galt, late supply officer, bureau of constabulary	1,769.23
Total	4,175.05

PROPERTY LOSSES FROM UNAVOIDABLE CAUSES.

Paul Crank, late supply officer, bureau of constabulary, was found short of nonexpendable property to the value of ₱386.13. As the loss occurred through no fault of the officer, he was relieved from accountability by written consent of the governor-general, under the provisions of rule 29 of act No. 90.

C. J. Bailey, supply officer, bureau of constabulary, was found short of nonexpendable property to the value of ₱897.57, and was relieved in the same manner.

J. Lawton Taylor, a provincial supervisor, and J. H. Nelson, supply officer, were found short of nonexpendable property to the value of ₱134.46 and ₱159.52, respectively, and were relieved by written consent of the governor-general, as provided in section 42 of act No. 1402.

In addition to the above there are unsettled claims in course of adjustment amounting to ₱23,085.44.

In the case of M. T. E. Ward, late supply officer, bureau of constabulary, judgment in the court of first instance against the Union Surety Company was secured in the sum of ₱1,324.93, but the amount is uncollected.

The number of property returns on hand July 1, 1905, was 427, and 2,469 were received during the fiscal year, making a total of 2,896. Of these 2,480 have been examined, leaving a total remaining unaudited at the close of the fiscal year of 416.

ACCOUNTS COVERING STAMP STOCKS AND OTHER PAPER HAVING A FIXED MONEY VALUE WHEN ISSUED.

The following accounts show the money value of stamped and other paper having a money value received and issued by the officers charged with the same, as indicated:

Internal revenue stamp account.

[Act No. 1189.]

Item and date.		Amount.	
		Debit.	Credit.
Stamp stock on hand July 1, 1905		₱2,556,308.50	
Stamp stock received from the insular treasurer:			
July 3, 1905	₱233,700.00		
July 27, 1905	160,000.00		
August 9, 1905	32,400.00		
September 5, 1905	2,414,000.00		
October 7, 1905	110,000.00		
October 21, 1905	104,000.00		
December 1, 1905	80,000.00		
December 26, 1905	210,400.00		
January 22, 1906	40,000.00		
February 6, 1906	1,816,100.00		
April 3, 1906	835,900.00		
		6,036,500.00	
Stamp stock returned by provincial treasurers		40,844.80	
Stamp stock transferred to provincial treasurers:			
July, 1905	₱840,562.50		
August, 1905	199,090.00		
September, 1905	668,971.00		
October, 1905	469,008.00		
November, 1905	393,197.00		
December, 1905	594,665.00		
January, 1906	1,250,918.00		
February, 1906	384,845.00		
March, 1906	809,176.00		
April 1906	127,382.00		
May, 1906	560,904.00		
June, 1906	1,210,255.00		
			₱7,508,973.50
Stamp stock on hand June 30, 1906			1,124,679.80
Total		8,633,653.30	8,633,653.30

Internal revenue documentary stamp account.

[Act No. 1189.]

Item and date.		Amount.	
		Debit.	Credit.
Stamp stock on hand July 1, 1905		₱193,407.00	
Stamp stock received from the insular treasurer:			
July 3, 1905	₱8,000.00		
July 6, 1905	6,000.00		
August 9, 1905	16,000.00		
October 7, 1905	12,000.00		
October 21, 1905	12,000.00		
December 1, 1905	8,000.00		
December 26, 1905	2,000.00		
January 12, 1906	27,000.00		
February 6, 1906	15,000.00		
April 3, 1906	4,000.00		
April 3, 1906	10,000.00		
May 3, 1906	3,000.00		
June 21, 1906	17,000.00		
		140,000.00	
Stamp stock returned by provincial treasurers		24,564.86	

Internal revenue documentary stamp account—Continued.

Item and date.		Amount.	
		Debit.	Credit.
Stamp stock transferred to provincial treasurers:			
July, 1905	₱24,574.00		
August, 1905	11,327.62		
September, 1905	12,642.38		
October, 1905	14,120.00		
November, 1905	13,310.00		
December, 1905	17,383.00		
January, 1906	13,974.00		
February, 1906	9,956.00		
March, 1906	8,140.00		
April, 1906	18,752.00		
May, 1906	21,232.00		
June, 1906	9,800.50		
			₱175,211.50
Stamp stock on hand June 30, 1906			182,760.36
Total		₱357,971.86	357,971.86

Internal revenue cedula account.

[Act No. 1189.]

Item and date.	Class A.	Class B.	Class C.	Class D.
DEBIT.				
Cedula stock on hand July 1, 1905	₱111,349	₱294,700	₱3,500	₱4,800
Cedula stock received from the insular treasurer:				
October 25, 1905	150,000			
November 1, 1905	100,000			
November 3, 1905	50,000			
November 8, 1905	199,000			
November 28, 1905	131,000			
November 29, 1905	100,000			
December 1, 1905	100,000			
December 11, 1905	100,000			
December 23, 1905	140,000			
January 19, 1906	60,000			
January 23, 1906	40,000			
February 19, 1906	30,000			
March 12, 1906	10,000			
March 13, 1906	30,000			
March 22, 1906	60,000			
April 21, 1906	14,500			
April 25, 1906	21,000			
Cedula stock returned by provincial treasurers	236,443	847	7,317	5,270
Total debit	1,683,292	295,547	10,817	10,070
CREDIT.				
Cedula stock transferred to provincial treasurers:				
July, 1905		9,000		200
August, 1905		5,100		
September, 1905	9,000	7,800		
October, 1905	59,600	3,300		250
November, 1905	660.400	11,700	200	450
December, 1905	597,900	1,100	350	350
January, 1906	23,700	2,400	200	150
February, 1906	76,000	1,500	350	50
March, 1906	91,900	89,900	200	100
April, 1906	61,900	80,100	550	1,400
May, 1906	3,700	24,500	100	300
June, 1906	3,000	23,300	400	400
Cedula stock on hand June 30, 1906	96,192	35,847	8,467	6,420
Total credit	1,683,292	295,547	10,817	10,070

Account of opium users' certificates.

[Act No. 1461.]

Item and date.		Amount.	
		Debit.	Credit.
Certificates received from the bureau of printing:			
March 30, 1906	₱900		
April 4, 1906	2,900		
April 5, 1906	500		
April 6, 1906	4,600		
April 7, 1906	5,900		
April 16, 1906	7,200		
April 19, 1906	4,000		
April 26, 1906	14,000		
		₱40,000	
Certificates returned by the provincial treasurer of Bataan Province		180	
Certificates transferred to provincial treasurers:			
April, 1906	4,900		
May, 1906	12,800		
June, 1906	1,300		
			₱19,000
Certificates on hand June 30, 1906			21,180
Total		40,180	40,180

Account of old internal revenue stamps.

Item and date.		Amount.	
		Debit.	Credit.
Stamp stock on hand July 1, 1905		₱36.00	
Stamp stock received from the city assessor and collector of Manila:			
July, 1905	₱2,304.35		
December, 1905	33.69		
		2,338.04	
Stamp overage found by the committee upon taking inventory, January, 1906.		2.15	
Stamp stock destroyed by committee, January, 1906			₱2,340.19
Stamps filed with court records as exhibits in fraud cases, as evidence			36.00
Total		2,376.19	2,376.19

Cattle registration stamp account of the insular treasurer.

Item and date.		Amount.	
		Debit.	Credit.
Stock on hand June 30 1905		₱210,400.00	
Stock transferred to provincial treasurers:			
July, 1905	₱69,000.00		
August, 1905	37,000.00		
September, 1905	11,000.00		
October, 1905	18,000.00		
November, 1905	21,500.00		
December, 1905	17,000.00		
January, 1906	26,500.00		
February, 1906	4,000.00		
March, 1906	6,400.00		
			₱210,400.00
Total		210,400.00	210,400.00

By act No. 1465, which took effect July 1, 1906, the use of cattle registration stamps was discontinued. By the provisions of that act certificates of registration and transfer of cattle are to be printed in form prescribed by the executive secretary and approved by the auditor. Under the authorization a design in lieu of a stamp is printed upon the certificates themselves, the certificates are consecutively numbered, and the collecting officers to whom issued become accountable therefor.

Customs stamps on hand received and issued during the fiscal year 1906 by the insular collector of customs.

Date.	Received.	Issued.
On hand July 1	₱250,582.40	
July		₱4,398.00
August	5,726.60	4,672.00
September	1,333.40	5,262.00
October	2,227.20	3,868.00
November		5,302.40
December		4,935.00
January	17.40	5,329.00
February	20.80	4,074.00
March		4,214.00
April		5,560.00
May		9,474.00
June		5,646.00
Balance on hand June 30		197,173.40
Total	259,907.80	259,907.80

POSTAGE-STAMP ACCOUNT.

Stamp account of the chief of the division of stamps and supplies, bureau of posts.

Item and date.		Debit.	Credit.
Stock on hand July 1, 1905		₱393,832.11	
Received from the United States Post-Office Department:			
July, 1905	₱45,610.00		
October, 1905	6,611.20		
November, 1905	54.80		
December, 1905	3,088.00		
February, 1906	131,923.60		
March, 1906	4,601.20		
April, 1906	231,055.40		
		422,944.20	
Damaged and other stock returned by postmasters:			
July, 1905	731.72		
August, 1905	799.74		
September, 1905	76.56		
October, 1905	368.82		
November, 1905	874.33		
December, 1905	93.78		
January, 1906	28.58		
February, 1906	22.96		
March, 1906	2.18		
April, 1906	475.66		
May, 1906	141.06		
June, 1906	.40		
		3,615.79	
Stock transferred to postmasters:			
July, 1905	19,851.92		
August, 1905	16,583.38		
September, 1905	21,764.92		
October, 1905	18,650.38		
November, 1905	19,732.06		
December, 1905	37,866.38		
January, 1906	94,210.40		
February, 1906	69,268.20		
March, 1906	37,295.18		
April, 1906	50,705.42		
May, 1906	51,650.10		
June, 1906	41,587.24		
			₱479,165.58
Stock lost in transit by unavoidable casualty			37.20
Damaged stamps and obsolete "postage-due" stamps destroyed by committee appointed in accordance with act No. 215			62,725.99
Stock on hand June 30, 1906			278,463.33
Total		820,392.10	820,392.10

THE BALANCE SHEET.

Consolidated balance sheet of the financial condition of the government of the Philippine Islands on June 30, 1906, showing transactions of the fiscal year 1906 in detail, and including Mexican and Spanish-Filipino currency transactions at the ratio of 1.30 to 1.

General ledger accounts.	Receipts at and withdrawals from the insular treasury, and distribution of available funds.		Revenues and expenditures of the fiscal year 1906.		Resources and liabilities on June 30, 1906.		Surplus and deficiency account.	
	Debit.	Credit.	Debit.	Credit.	Debit.	Credit.	Debit.	Credit.
Balances from previous years	₱49,832,322.86							₱6,237,371.97
Receipts at the treasury	213,890,320.68½							
Withdrawals from the treasury		₱218,696,081.02½						
Available for appropriation		6,315,168.11						
Appropriations undrawn		13,082,895.71						
Available for refundment or redemption (depositary funds and silver certificates reserve)		25,628,498.70						
Customs revenue				₱14,839,653.86				
Postal revenue				484,228.77				
Internal revenue				5,130,790.72				
Miscellaneous revenue				2,475,952.69				
Gain in exchange of currency due to arbitrary expression				793.81½				
Insular expenditures			₱17,392,535.81½					
Allowances under section 42, act No. 1402			3,820.76					
Losses under section 41, act No. 1402				878.46				
Insular aid to provincial expenses			2,897,201.67					
Spanish seized funds				3,836.01				
The insular treasurer's cash balance					₱45,122,814.29			
The insular treasurer's liability on unissued silver certificates					5,590,000.00			
Gold standard fund						₱2,170,958.44		
Philippines money-order fund						996,375.92		
United States money-order fund						256,403.72		
Bonded indebtedness						26,000,000.00		
Outstanding postal drafts						16,323.30		
Friar lands bonds sinking fund						50,000.00		
Sewer and waterworks bond sinking fund						38,740.00		
Refundable surplus on customs auction sales						419.47		
Invalid money-order fund						4,447.74		
Outstanding liability on invalidated checks of disbursing officers						7,033.01		
Loans to provinces					812,004.96			
Refundable export duties						813,363.20		
The city of Manila					3,400,638.68			

Outstanding warrants						96,251.77		
Friar lands fund					12,923,655.88			
Moro Province					80,631.92			
Depositary funds						11,218,498.70		
Silver certificates redemption fund						14,410,000.00		
Internal revenue refundable to provinces						632,005.74		
Public works and permanent improvement fund					3,494,893.13			
Congressional relief fund						681,812.45		
Manila sewer and waterworks construction fund						1,590,629.65		
Balances in the hands of collecting and disbursing officers					4,804,418.92			
Unissued silver certificates (per contra entry insular treasurer's liability)						5,590,000.00		
Provincial governments (per contra collecting and disbursing officers' balances)						2,476,368.89		
Miscellaneous special funds						299,477.73		
Total	263,722,643.54½	263,722,643.54½	20,293,558.24½	22,936,134.32½	76,229,057.78	67,349,109.73		
Excess of receipts over expenditures carried to surplus and deficiency account			2,642,576.08					2,642,576.08
Total			22,936,134.32½	22,936,134.32½				
Excess of resources over liabilities						8,879,948.05		
Total					76,229,057.78	76,229,057.78		
Net surplus carried forward to succeeding fiscal year							₱8,879,948.05	
Grand total							8,879,948.05	8,879,948.05

Respectfully submitted.

A. L. Lawshe, *Auditor.*

The Secretary of War.
The Governor-General of the Philippine Islands.
The Philippine Commission.

REPORT OF THE SECRETARY OF PUBLIC INSTRUCTION.

REPORT OF THE SECRETARY OF PUBLIC INSTRUCTION.

Department of Public Instruction,
Manila, September 28, 1906.

Gentlemen: The secretary of public instruction begs leave to submit to the honorable the Philippine Commission the fifth annual report of the work accomplished during the year ending June 30, 1906 (unless otherwise stated), by those bureaus of the insular government under the executive control of the department of public instruction.

Prior to the reorganization of the department of public instruction it was composed of the bureau of education, the bureau of public printing, bureau of architecture, bureau of archives, bureau of patents, copyrights, and trade-marks, the Official Gazette, and the American Circulating Library of Manila. By virtue of the reorganization act the bureau of architecture, bureau of archives, bureau of patents, copyrights, and trade-marks, the Official Gazette, and the American Circulating Library of Manila ceased to be separate bureaus. The American Circulating Library of Manila and the ethnological survey, which had formerly been a bureau of the department of the interior, became divisions of the bureau of education. The bureau of architecture was abolished and the work of that bureau assigned to the bureau of public works. The Official Gazette, the bureau of archives, and the bureau of patents, copyrights, and trade-marks ceased to be separate bureaus and became divisions of the executive bureau. By virtue of the same act the bureau of the insular purchasing agent, which had been formerly under the jurisdiction of the governor-general, was transferred to the department of public instruction under the name of the bureau of supply. The bureau of prisons was created, which was given jurisdiction over Bilibid Prison, its shops, quarries, and penal settlement, and on it was conferred general supervision over all provincial jails throughout the islands. This bureau was placed under the jurisdiction of the department of public instruction, thereby transferring the jurisdiction over Bilibid Prison from the department of commerce and police. The bureau of the insular cold storage and ice plant was transferred from the department of finance and justice to the department of public instruction under the name of the bureau of cold storage. The department of public instruction as now constituted is composed of the bureau of education, bureau of supply, bureau of prisons, bureau of printing, and bureau of cold storage.

BUREAU OF EDUCATION.

CHANGES IN ORGANIZATION, PERSONNEL, AND DUTIES.

During the year three school divisions have been created by the separation of Isabela from Cagayan, Bataan from Pampanga, and Antique from Iloilo, thereby giving to each of the provinces the status of a school division, with a separate division superintendent.

By virtue of act No. 1462 provision has been made for the appointment to the provinces of Mindoro, Palawan, Benguet, and Lepanto Bontoc of separate division superintendents, thereby relieving the provincial governors of the educational duties which they are now required to perform in addition to those of a purely gubernatorial character.

By the passage of act No. 1401 the position of provincial supervisor was abolished and the division superintendents, or acting division superintendents, of the various provinces were made members of the provincial boards and perform the duties on the provincial boards formerly required of the provincial supervisors. The additional duties imposed upon division superintendents in consequence of their membership in the provincial boards are very heavy and require a considerable portion of their time, which ought to be employed in giving attention to the schools. The director of education is of the opinion, however, that the time lost to division superintendents of schools through their membership in provincial boards is more than compensated for by reason of the fact that membership in the boards enables the division superintendents to put the boards in possession of the real condition and wants of the schools, and to obtain from the boards such administrative action as will best promote the interests of education in the provinces.

TEACHING FORCE.

The American teaching force consists of 763 permanent and 68 temporary appointees. The following table will show the number of teachers appointed each year since the organization of the bureau of education, the number that were separated from the service, and the number of each year's appointees who are now in the service:

Total number of teachers appointed in—		
1900	10	
1901	1,061	
1902	169	
1903	156	
1904	290	
1905	288	
1906	100	
Unknown	58	
Grand total		2,132
Total number of teachers resigned of those appointed in—		
1900	5	
1901	982	
1902	105	
1903	75	
1904	56	
1905	9	
1906	1	
Unknown	43	
Grand total		1,276
Total number of teachers now in the service appointed in—		
1900	5	
1901	79	
1902	64	
1903	81	
1904	234	
1905	279	
1906	99	
Unknown	15	
Grand total		856

The following table will show the salaries paid and number of teachers allowed at each salary, and the number of regular and temporary employees receiving the same June 30, 1906:

Salaries.	Allowed by appropriation.	Employed.	
		Regular.	Temporary.
$600		1	1
660		1	
900	39	68	33
1,000	150	68	6
1,020		1	
1,080		3	
1,100	50	57	
1,140		5	
1,200	350	328	12
1,260		3	
1,300	60	57	
1,320		1	
1,350		3	
1,400	80	72	
1,500	50	50	
1,600	10	9	
1,800	6	6	
2,000	3	2	
Total	800	745	52

The total annual salaries amounted to ₱1,926,868.68.

During the school year 1906 there were employed in the bureau of education 4,719 native teachers, 324 of whom were insular teachers and 4,395 municipal teachers.

The following table will show the salaries and number of native insular teachers allowed and the regular and temporary appointments actually made:

Salaries.	Allowed by appropriation.	Employed.	
		Regular.	Temporary.
$72		1	
90			1
120		1	3
150			2
180		7	39
210		1	
240	160	88	21
270		1	
300	40	50	4
360	20	41	2
420	20	13	
480	20	17	
540	20		
600	14	5	1
Total	294	225	73

The average annual salary paid to Filipino insular teachers was, for men, ₱515.64; women, ₱471.60. Average salary paid municipal teachers was, for men, ₱216.12; women, ₱211.44.

On March 31, 1906, there were 1,020 municipal schools, as compared with 788 at the time of the last annual report, an increase of 232; and 2,146 barrio schools, as opposed to 1,866 at the time of the last annual report, an increase of 280. The total number of schools now established in the islands is 3,340, as opposed to 2,924 at the time of the last annual report. During the year 439 additional primary schools were established, 1 intermediate, 1 high school, and the number of night schools was reduced by 225. In addition to the schools devoted entirely to technical instruction, such instruction including carpentry, iron working, and other forms of tool working, mechanical drawing, agriculture, and domestic science for girls, such as is given ordinarily as a department of provincial high schools, is given in 34 other schools embracing 28 provinces.

ENROLMENT AND ATTENDANCE.

It was found that the enrolment in primary schools greatly exceeded the facilities, and directions have been issued to exclude not only children below the age of 6, but if necessary to make the age of entrance 8 to 9 or 9 to 10 years, and to insist upon regularity in attendance. The method formerly employed in reporting the enrolment of pupils was found to be inaccurate and was therefore discontinued. No account has been taken during the past year of the total enrolment except for the month of March, the last month of the school year, during which there was a total enrolment of 375,554 made up as follows:

Primary:		
First grade	264,243	
Second grade	73,074	
Third grade	27,386	
		364,703
Intermediate:		
Fourth grade	6,139	
Fifth grade	2,710	
Sixth grade	1,448	
		10,297
Secondary:		
Seventh grade	446	
Eighth grade	95	
Ninth grade	13	
		554
Total enrolment		375,554

The general attendance throughout the provinces has been quite satisfactory, being 85.2 per cent in the month of March, the best attendance obtained being in the city of Manila, 95 per cent, and in the provinces of Union and Tarlac, 94 per cent.

SCHOOL BUILDINGS.

The total number of school buildings now in use in the islands is 3,160, 374 of which are furnished rent free, 317 are leased, and 2,469 are owned by the government. This is an increase of 126 over the previous year, of which 50 are furnished rent free, 30 are leased, and 46 are owned by the government. The average cost of the new school buildings for the year has been ₱1,355. The appropriation for schools for the fiscal year 1906 was ₱2,417,450; for the fiscal year 1907 the Commission has appropriated ₱3,000,000.

The extension of the educational system of the city of Manila has been somewhat retarded, owing to the financial condition of the city and the scarcity of suitable buildings for school purposes. During the latter part of the school year the department of public instruction was successful in securing from the War Department the group of buildings known as Cuartel Meisic and the quartermaster shops, which have been converted into school buildings and will provide additional accommodations for several thousand school children.

The great demand for extension of the educational system, and particularly for the establishment of trade schools throughout the provinces and the extension of agricultural schools, make it extremely desirable that the bureau of education have a larger appropriation with which to develop their work. It is recommended that not less than ₱4,000,000 be laid aside for this purpose in the next appropriation bill.

During the fiscal year just past the provincial governments have shown a commendable improvement in their interest in the development of the schools. The total amount expended by provinces from provincial funds amounted to ₱166,028.35, an average of ₱4,723.66 for each province. It is hoped that the provincial governments will steadily increase this amount, as it is still too small a proportion of their revenues considering the work to be done and the object to be gained.

By act of the Commission dated February 19, 1906, the land tax was suspended for one year, ending December 31, 1906. In the last annual report it was pointed out that any permanent suspension of land taxes would result in practically crippling the municipal schools. It is therefore most earnestly recommended that the land tax for schools be not again suspended, but that it be collected as before. The reports of the provincial governors show increases in the productive area, and most of the provinces ought now to be able to support this tax better than at any previous time in their history.

A very encouraging sign to those interested in the development and prosperity of the Philippine Islands is the lively interest displayed by the municipalities in providing themselves with adequate and suitable school buildings and increasing their school facilities. The tendency to make donations of money, materials, and service has shown a decided increase during the fiscal year.

REFORM SCHOOL.

The necessity for some institution for the care of juvenile offenders has been recently brought to the attention of the authorities. It was found that a number of boys ranging from 13 to 16 years of age were confined in a certain section of Bilibid Prison, which was believed to be an undesirable place for them and not in accord with modern practice in dealing with such cases. For a while there was a plan to establish an agricultural school for reform purposes, but the finances of the government were not in such condition as to warrant the establishment of an additional institution.

Act No. 1438, enacted January 11, 1906, provides for the commitment of juvenile offenders between the ages of 8 and 18 years to charitable or educational institutions instead of to the public prisons or jails, and for the transfer of such offenders from public prisons or jails to such charitable or educational institutions; provided, that before making such commitment or transfer consideration shall be given to the religion of the prisoner and that of his parents or next of kin, and that no commitment or transfer to such charitable or educational institutions under the control and supervision of a religious sect or denomination shall be made except upon the approval of the parents or next of kin of the prisoner.

Owing to the financial condition of the insular government, no provision has been made for the establishment of a reform school for juvenile offenders. However, the archbishop of Manila has established an industrial school in connection with the Hospicio de San José, and has agreed to take over the guarding, care, and education of juvenile offenders, the government to pay the sum of 40 centavos a day each for maintenance, which is the cost of maintenance per day per prisoner at Bilibid Prison. There are now in the industrial school under the control of the archbishop of Manila 55 prisoners, and an effort is being made to clear the prisons throughout the archipelago of all other juvenile offenders.

MEDICAL SCHOOL.

Act No. 1415 was passed on December 1, 1905, authorizing the establishment of a medical school. Under the terms of this act the secretary of public instruction is chairman of the board of control, the other three members being the secretary of the interior, one member of the Philippine Commission, and one other member to be designated by the governor-general. Dr. T. H. Pardo de Tavera was the Philippine Commissioner named by Governor-General Ide to serve on this board, and Dr. Paul C. Freer, director of the bureau of science, the other member.

The board of control has had several meetings and conferences and has taken preliminary steps for the organization of the school by providing for seven chairs to be filled by available physicians and surgeons who will serve without compensation, as follows:

1. Chair of chemistry.
2. Chair of history of medicine.
3. Chair of tropical medicine.
4. Chair of pathology.
5. Chair of surgery.
6. Chair of medical jurisprudence.
7. Chair of hygiene and public health.

Some forty students are now undergoing a course in the normal school and other schools in Manila with a view to equipping themselves to take the medical course, and it is planned to have the college open at the beginning of the next school year, namely, June, 1907.

For further detailed information relating to the bureau of education, attention is invited to the report of the director of education, attached hereto and made a part of this report.

BUREAU OF SUPPLY.

Under and by virtue of the provisions of the reorganization act (No. 1407) the bureau of the insular purchasing agent was transferred from the jurisdiction of the governor-general to the department of public instruction, under the name of "bureau of supply," and the title of the official in charge was changed from insular purchasing agent to "purchasing agent."

The purchases made by the purchasing agent during the past year amount to ₱3,335,037.07, of which ₱2,356,055.71 was expended for supplies purchased in Manila and ₱978,981.36 for supplies purchased in the United States, including in the value of goods purchased in the United States the sum of ₱182,149.86, paid to Mr. W. W. Robinson, Seattle, Wash., by the bureau of insular affairs for hay and grain furnished under a three years' contract, the sum of ₱272,257.94 paid by the bureau of insular affairs for schoolbooks for the bureau of education, and ₱59,755.40 for special supplies for the bureau of printing. Of course these schoolbooks and printing supplies, such as are required by the bureau of education and the bureau of printing, respectively, can not be secured in sufficient quantities in the city of Manila. From this it will be seen that in all not more than 29 per cent of the total quantity of supplies has been purchased in the United States, and that, leaving out schoolbooks and printing supplies, hay and grain, which can not be secured in the Philippine Islands, the total percentage of goods purchased in Manila amounts to 81 per cent. Medicines, inks, glassware, and crockery are but rarely purchased in Manila, due to the fact that the purchasing agent is able to buy such supplies to very much better advantage in the United States. On these supplies the merchant must charge a higher price to protect himself against breakage, and, in case of rush orders, he is compelled to incur the expense of cabling at full rates. The purchasing agent is absolutely protected by insurance on all such goods and has the advantage of the government rate for cabling. Moreover, the purchasing agent has the benefit of lower freight and lighter rates than that ordinarily accorded to local merchants.

The assets and liabilities of the bureau of supply are as follows:

Assets.

Supplies (merchandise in stock)	₱1,799,196.75
Accounts receivable	764,373.44
Accounts receivable (vouchers with auditor for settlement)	132,208.65
Supplies in transit from United States (paid for)	84,215.62
Appropriation "Purchase of supplies" (available funds with treasurer)	397,154.35
Cash in hands of disbursing officer (on deposit with treasurer)	81,647.28
Cash in hands of disbursing agent, Washington, D. C	46.70
Cash in hands of cashier	372.26
Total	3,259,215.05

Liabilities.

Appropriation "Purchase of supplies" (working account)	₱1,750,000.00	
Accounts payable	84,448.25	
Transportation payable (1361)	10,545.73	
Total		1,844,993.98
Surplus		1,414,221.07

The expenses and earnings of the bureau of supply for the fiscal year were as follows:

Expenses.

Salaries and wages	₱267,110.05	
Contingent expenses	91,811.52	
Act No. 231, expense	8,666.34	
Fire insurance (act No. 231)	7,406.88	
Total		₱374,994.79

Earnings.

Surcharge, "department"	₱273, 513. 30	
Surcharge, "province"	44, 484. 62	
Total		₱317, 997. 92
Loss		56, 996. 87

The total value of condemned supplies was ₱38,470.33, from the sale of which ₱2,255.83 was realized, leaving a loss on condemned supplies of ₱36,214.50. Almost, if not all, of the supplies condemned and sold were tinned goods taken over from the constabulary supply store, which are most difficult to preserve in a tropical climate.

Sales made by the purchasing agent since the organization of the bureau are as follows:

Fiscal year—	
1902	₱1, 970, 549. 78
1903 (59.05 per cent increase)	3, 134, 141. 98
1904 (69.41 per cent increase)	5, 309, 474. 37
1905 (7.01 per cent decrease)	4, 936, 976. 79
1906 (26.97 per cent decrease)	3, 605, 250. 07
Total	18, 956, 392. 99

Surcharge earnings of the bureau since its organization are as follows:

Fiscal year—	
1902	₱167, 057. 84
1903 (70.6 per cent increase)	284, 922. 00
1904 (67 per cent increase)	475, 938. 01
1905 (6 per cent decrease)	447, 405. 90
1906 (28.9 per cent decrease)	317, 997. 92
Total	1, 693, 321. 67

The operating expenses of the bureau during each fiscal year since its organization are as follows:

Fiscal year.	Salaries and wages.	Contingent expense.	Total.
1902	₱152, 932. 44	₱144, 776. 44	₱297, 708. 88
1903 (46.61 per cent increase)	275, 742. 68	166, 684. 28	442, 426. 96
1904 (36.49 per cent increase)	384, 410. 84	219, 463. 07	603, 873. 91
1905 (7.03 per cent decrease)	380, 486. 68	180, 926. 04	561, 412. 72
1906 (36.07 per cent decrease)	267, 110. 05	91, 811. 52	358, 921. 57
Total	1, 460, 682. 69	803, 661. 35	2, 264, 344. 04

NOTE.—Percentage of net (cost) value of sales compared with operating expenses are as follows:

Fiscal year—	Per cent.	Fiscal year—	Per cent.
1902	16. 51	1905	12. 50
1903	15. 52	1906	10. 92
1904	12. 49		

Expenses incurred in connection with the commissary department amount to ₱6,886.82; earnings, ₱3,568.34; leaving a net loss of ₱3,318.48, added to the bureau of supply by the commissary supply store of the constabulary.

The following figures represent the total supplies sold during the fiscal year to the various bureaus of the insular government and to the provinces:

Insular	₱3, 094, 402. 66
Provincial	510, 847 41
Total	3, 605, 250. 07

The purchasing agent claims that the sum of ₱23,245.94, paid out of the "Purchase of supplies" appropriation in order to promptly meet emergencies of the occasion, should rightly have been paid out of the available funds provided by act No. 1225 and asks that this amount so paid out of the "Purchase of supplies" appropriation be returned to that appropriation. This office makes no recommendation in the matter, but submits the question to the Commission for such action as to it may seem proper. The sum of ₱20,746.67, it is claimed, was paid out of the "Purchase of supplies" appropriation to cover cost of galvanized-iron roofing furnished the inhabitants of various provinces in the islands for the purpose of relieving distress, etc., caused by locusts and other plagues, and the purchasing agent claims that it is a proper charge against the Congressional relief fund and that the sum so paid out of the "Purchase of supplies" appropriation should be returned to that appropriation. The undersigned is of the opinion that this sum is a just charge against the Congressional relief fund and should be returned to the "Purchase of supplies" appropriation, from which it was improperly taken. It is further claimed that the sum of ₱29,045.22 was diverted from the "Purchase of supplies" appropriation and utilized for the purpose of meeting expenses in the care of carabao and other expenses incurred by reason of the purchase by the government of such animals. There are not sufficient data on which to make a recommendation, and the question is therefore submitted to the Commission for such action as to it may seem proper.

The purchasing agent calls attention to the report of the reorganization committee, which recommends that warehouses for the bureau of supply be erected. The purchasing agent states that he is now paying rental amounting to ₱45,000 per annum, and that if a suitable up-to-date warehouse were constructed this high rental would be saved to the government and a material reduction made in operating expenses and cost of administration. The purchasing agent is of the opinion that a total saving of ₱65,000 would be made to the government by reason of the construction of the warehouses recommended by the reorganization committee. The committee is of the opinion that ₱100,000 would be saved. No statement is made as to the cost of the proposed warehouses, and no idea as to such cost can be gathered save and except from the statement made by the purchasing agent that his bureau stands ready to contribute ₱350,000 of its surplus toward putting this plan into effect at once. Whether by reason of the establishment of such warehouses the bureau of supply would save much more than the rental which is now paid is doubtful.

For further information and details see the annual report of the purchasing agent attached hereto.

BUREAU OF PRISONS.

By the terms of the reorganization act (No. 1407), on the 1st of November, 1905, the control of Bilibid Prison passed from the department of commerce and police to the department of public instruction. The objects of this change were, first, to compensate the department of public instruction for transfers of other bureaus that had been made from its jurisdiction in an effort to more nearly equalize the functions of the secretaries; and, secondly, to group the control of the analogous functions to the different departments, the department of public instruction having all of the bureaus engaged in manufacture or supply. As an effort is made to have all of the different government bureaus send all requests for repairs to Bilibid Prison, this fits in somewhat with the nature of service performed by the bureau of supply, the bureau of printing, and the bureau of cold storage. Moreover, the object of the Commission was, by means of the immense force, to emphasize the educational feature of the prison institution.

Up to November 1, 1905, the date upon which the reorganization act took effect, this office was known as Bilibid Prison and the officer in charge known as the warden of Bilibid Prison. Under the terms of the reorganization act it is now the bureau of prisons, with the added duty of supervision over all provincial jails throughout the archipelago, as recommended in the last annual report of the department of commerce and police, and the warden is now known as the director of prisons.

The total number of prisoners confined in Bilibid and the penal settlements at the beginning and end of the fiscal year 1906, was 4,721 and 4,539, respectively, a decrease of 182 prisoners, or about 4 per cent. The average number of prisoners has been from 4,033 to 3,700 during the present fiscal year.

The total cost of maintenance of the prisoners was ₱614,261.13, as compared to ₱581,456.17 for the previous year, an increase of ₱32,804.96. The cost per capita was ₱0.367 per day, as compared with ₱0.328 per day for the preceding year. This takes no account of receipts from the sale of manufactured articles. Crediting the profits from the industrial division, namely ₱147,648.99, the cost is reduced to ₱0.278 per capita per day. The gross cost of ₱0.367 per day is ₱134 per year. The prison has increased its facilities for manufacture and now has a system of giving willing prisoners an opportunity to very materially better their condition and to learn useful trades. The receipts from the sale of manufactured articles were ₱155,817.08, an increase of ₱104,215.69 over the previous year, or approximately 300 per cent.

On the 30th of June the location and number of prisoners were as follows:

Bilibid Prison	3,554
Hospital "B"	157
Iwahig penal colony	467
Camp Overton	152
Lingtong Prison quarries	86
San Lazaro Hospital	59
Luneta police station	22
Fort William McKinley	15
Fort San Pedro, Iloilo	10
Hospicio de San José	9
Clarian Prison, Zamboanga	8
Total	4,539

ROAD BUILDING.

ALBAY.

The road from Tabaco to Ligao, which was reported upon in the last annual report of the prison, was completed on September 23, 1905. The prisoners were then transferred to construct the Jovellar-Guinobatan road, but the appropriation did not suffice for the completion of the same and accordingly only three-fourths were finished, the remainder being left for the province to undertake from its own resources. The health of the prisoners remained reasonably good, no more efforts to escape were recorded, and 587 prisoners were returned to Bilibid.

CAMP OVERTON.

Of the 500 prisoners sent to Camp Overton 281 were returned during the year, and during July, 1906, the remaining prisoners were sent back and arrived in fine condition and much improved by their work. These men were selected from the long-term prisoners of the more undesirable kind of the third grade, and many of them came back excellent workmen.

LINGTONG PRISON QUARRIES.

On September 14, 1905, the prison opened a rock quarry in Bulacan for the purpose of quarrying stone for use in making extensions and improvements under contemplation at Bilibid. This work was continued as long as there was need of stone, the number of men on the work having been increased from time to time to 153. They were guarded by scouts, but need was felt by the military authorities for the use of the scouts for other purposes and the work was discontinued and the prisoners returned to Bilibid.

FORT WILLIAM M'KINLEY.

A large number of prisoners were sent to Fort McKinley to assist in laying out the grounds. The prison paid the expenses of these prisoners as though they were being maintained in Bilibid, and additional expense being borne by the military authorities. After a certain amount of grading of the road from Manila to Fort McKinley had been done it was found desirable to return the prisoners to Bilibid.

The practical result of all of these operations has been the return of all of the prisoners that were previously engaged outside of the confines of Bilibid Prison to the prison, which has a tendency to fill up the prison with a greater number of men that it is wise to maintain together in so small a place and between such high walls as prevail there. Accordingly, efforts have been made to devise uses for the prisoners in other places. A practical solution of the plan seems to be to increase very largely the penal settlement at Iwahig.

IWAHIG PENAL COLONY.

The number of prisoners at the settlement on July 1, 1905, was 239; the number on July 1, 1906, was 467, an increase of 228. In the last annual report of the department of commerce and police report is made of the outbreak on the part of 33 prisoners who made an effort to escape, 19 of whom were at large at the time of writing the report. All of these prisoners were either caught or killed, the mountain people being glad to earn the reward for escaped prisoners by bringing in those who could be found outside of the reservation, dead or alive.

During the years there were 38 returned to Bilibid and 46 died at the settlement. This high death rate is due partly to the great prevalence of cholera at the settlement in the early part of the year and partly to the fact that many of the prisoners sent down there were classed as old and decrepit. The health conditions in the settlement have steadily improved during the year.

Temporary quarters of nipa were constructed during the year to accommodate 650 prisoners. The settlement now has 450 acres of cleared land, of which about half is under cultivation. A hog-proof fence has been put around some of this land and the settlement is now ready to begin development on a more important scale than heretofore. With nearly 500 prisoners, mostly able-bodied, it seems as if more rapid progress should be made in the cultivation of the land. Indications are also that this plan was not sufficiently urged on the settlement, and the plan of self-government, which had been heretofore but a scheme, had never been put in operation, nor had the promises of the government that those prisoners who behaved themselves would be allowed to have their families with them ever been carried out.

In August, 1906, the prison secured the services of Maj. John R. White, of the constabulary, to take charge of the settlement and endeavor to develop it more rapidly and along permanent lines. Major White has the entire confidence of the authorities; he has a fine record of successful management of natives wherever he has been. He took charge of his new position September 6, 1906. His instructions are to establish a system of self-government, by which the conduct for the prisoners and the rules for the same shall be made by their own council and president. They are to have their own police—as, indeed, they have already had—and the system of making them responsible for their own conduct and the management of their own affairs is to be rapidly extended. The superintendent will have veto power over every act of the council or president, may return any prisoner to Bilibid, and may amend or qualify all of their acts. It is expected that he will use discretion in the exercise of this power and give them a de facto self-government. The prisoners have different grades of advancement, so as to have incentive, beginning with no privileges, first acquiring the right to vote, then the right to have a family, then the right to be eligible for office, then the right to be allotted some land to cultivate themselves, perhaps on a cooperative basis, by which they share in the receipts received from the product of their own plantation as they improve their estate, and they to get an additional percentage of the receipts from the sale of the products until, after a certain number of years, they are to be recommended for pardon, conditional upon staying a certain length of time in the settlement. At that time it may become desirable to give them title to some of the land and some other privileges in order to give them a start in life.

An effort is to be made to make the settlement profitable and to use every labor-saving device in order to get the most scientific production possible. It is expected to plant large amounts of cocoa trees, hemp, cacao, rice, and possibly rubber, and small amounts of tobacco, sweet potatoes, peas, and some fruit trees. An effort will be made to make the place beautiful and orderly. A plan is being prepared for the layout of substantial buildings of permanent construction and good design by the consulting architect. The roads will be carefully made and well maintained and all of the houses and grounds will be kept scrupulously clean and well maintained. Every effort will be directed toward making the settlement self-supporting as soon as possible.

HEALTH.

Under the terms of the reorganization act, the supervision of the health in Bilibid was transferred to the director of health, in whose report reference will be found as to the condition of Bilibid Prison. There have been two separate outbreaks of cholera, the first occurring August 27, 1905, resulting, at the beginning of the recent outbreak of cholera, in a total of 29 cases and 21 deaths. The subjects were found to be infected with an organism of a most virulent type.

The bureau of health upon assuming control of the sanitary conditions ended the cholera situation by drastic measures within thirty-six hours. No more cholera appeared in Bilibid until June 28, 1906, when by some means untraceable it was brought in again, but this time it was brought under more rapid control and stamped out. There were 18 cases and 7 deaths during this time, the last case occurring on September 14, 1906. Full report of the action taken at that time may be found in the annual report of the Secretary of the Interior.

The supervision of Hospitals A and B is vested in the bureau of health. The death rate has very largely decreased under this supervision but is still high, larger than it ought to be, and active measures are urgently recommended toward providing better sanitary arrangements for the prisoners. To this end the director of health has recommended a new sewerage system for the prison, and that the old bamboo beds be removed and replaced by beds of canvas having iron frames, which can be taken up at any time and disinfected.

It is believed that no more than 2,500 men can be advantageously housed in Bilibid, and it is therefore recommended that just so fast as the Iwahig settlement can be made ready to receive and assimilate more prisoners that the number sent there be increased from the present rate of 75 each two months to the rate of 75 per month. This will insure the relief of Bilibid and give within a reasonable length of time enough hands at the settlement to accomplish the great works under contemplation there.

For further details attention is called to the report of the director of prisons, hereto attached.

BUREAU OF PRINTING.

Formerly this bureau was designated as the bureau of public printing. This name was changed by the reorganization act (No. 1407) to that of the bureau of printing. This bureau was left by the reorganization act under the jurisdiction of the department of public instruction. Its duties, however, were increased by that act by transferring to the bureau the duty of printing, selling, and distributing the Spanish and English editions of the Official Gazette, and all other publications of the insular government. Prior to the adoption of the reorganization act, and subsequent to the year 1903, no actual charge was made against the appropriations of bureaus for work done by the then bureau of public printing. The result of this system was that bureaus, as a rule, were not as economical in requiring printing as they would have been had they been obliged to pay for their printing out of current appropriations. By virtue of the reorganization act appropriations must be made for printing required by the bureaus. Prior to the fiscal year 1905–6, all printing was billed and based on a scale of prices recognized in the United States as reasonable for various kinds of printing work. In actual operation, however, it developed that this scale of prices was far above the actual cost of production, and during the previous fiscal year the scale was revised as to all items which experience had shown to be above cost, for the purpose of bringing about a reduction of 20 per cent on the total cost of printing. Of course the cut was not horizontal, and as it would have been extremely difficult to have figured the exact cost of each job, under the new scale, it was decided to give credits for the difference between the scale of prices and the cost of production after that cost had been determined for a given period. Under this system a credit refund of 24 per cent was made on all deliveries for November and December, 1905, and January, 1906; 17 per cent on all deliveries for February, 1906; 12 per cent on all deliveries for March and April, 1906; 28 per cent on all deliveries for May, 1906; and 30 per cent on all deliveries for June, 1906. This office ruled that the cost of production should be determined on the basis of salaries and wages paid, supplies expended, actual expense of maintenance and repair of the building, and an annual allowance of 10 per cent for wear and tear of equipment. As compared with the fiscal year 1905, there was a decrease of 26 per cent in the total value of printing done during the fiscal year. Of this decrease it is believed that ₱32,672.90 was the resultant saving due to the provision of the reorganization committee requiring payment for all printing executed, as the amount expended for salaries and wages and for the supplies consumed in operation was that much less than for the previous year. The experience of the last year has shown that a new scale of prices can be adopted which will reduce the price of printing to the various bureaus by still more closely approximating the cost of production.

In accordance with act No. 650, 71 apprentices are now receiving a three years' course of instruction in the printing trade, and under its provisions one apprentice has been graduated from the composing room, 1 from the bindery, 2 from the electrotype and stereotype room, and 1 from the press room. Several more apprentices have nearly completed their three years' term of service and their graduation from the various divisions of the printing bureau will follow in due course, providing their services continue to be efficient and satisfactory.

By reason of the great progress made by the native force employed in the printing bureau, and especially of the native apprentices, the number of American craftsmen employed in the bureau has been decreased during the past year by one-fifth. The dependence of the bureau of printing on the United States for its skilled labor has been steadily reduced, almost from the time of its organization, as may be seen from the following table:

Employed.	Americans.	Filipinos.
September 15, 1902	52	56
September 15, 1903	56	143
September 15, 1904	43	166
September 15, 1905	34	212
August 10, 1906	27	194

The only Americans now employed by the bureau of printing are the director and assistant director of printing, foreman of printing, the computer, the jacket writer, the foreman and assistant foreman of the composing room, linotype machinist, four proof readers, two copyholders, foreman and assistant foreman of the bindery, foreman and assistant foreman of the press room, three pressmen, foreman and assistant foreman of the electrotype and stereotype room, foreman and assistant foreman of the photoengraving room, the electrician-machinist in charge of the power plant, and the superintendent of the stock and paper warehouse.

There was appropriated for the bureau of printing, under and by virtue of act No. 1416, ₱281,700 for salaries and wages, and ₱135,000 for contingent expenses. In addition, there was a refund to George B. Hedges for accrued leave amounting to ₱788.88, which left to the credit of salaries and wages the total sum of ₱282,488.88. For the salaries of classified employees there was expended ₱146,759.01; for craftsmen, laborers, etc., ₱80,555.57; apprentices, ₱21,484; contingent work, ₱10,774.93; and to George B. Hedges for accrued leave ₱788.88, making a grand total of ₱260,362.39 expended for salaries and wages, and leaving a credit balance to the appropriation of ₱22,126.49, to which should be added ₱16.85, the balance available remaining from appropriation for 1905, giving ₱22,143.34 available to meet outstanding obligations for salaries and wages.

There was expended on general expense vouchers ₱5,822.30, and on "Vouchers, bureau of supply," ₱72,983.08; for cablegrams, ₱188.76, making a grand total of ₱78,994.14 expended for contingent expenses, and leaving an unexpended balance of ₱56,005.86 in the appropriation for contingent expenses, to which balance should be added ₱3,918.84, available for contingent expenses out of the appropriation for 1905, and giving a total of ₱59,924.70 available to meet outstanding obligations on account of contingent expenses for the fiscal years 1905 and 1906.

The outstanding obligations under salaries and wages amount to ₱158.94, and the outstanding obligations chargeable to contingent expenses ₱78,120.93, leaving a balance on account of salaries and wages of ₱21,984.40, and a deficiency on account of contingent expenses of ₱18,196.23, of which amount ₱18,000 is chargeable against the appropriation for the fiscal year 1907, in accordance with the resolution of the Commission dated May 29, 1906.

The total product of the bureau of printing for the fiscal year 1906 was ₱522,084.46. For the purpose of determining the total output of the printing plant, giving to it a bookkeeping credit for its entire product, there should be added to this sum of ₱522,084.46 the sum of ₱1,895.62 for sales of waste paper, ₱1,703.55 for destroyed stock, 10 per cent on subscriptions and sales of documents for handling, ₱1,730.06; stock on hand in excess of the balance on hand June 30, 1905, ₱221.36, making total credits for production of the plant ₱527,635.05.

The total cost of production, including salaries and wages, for the fiscal year 1906 was as follows:

Salaries and wages (exclusive of ₱788.88 accrued leave paid to George B. Hedges)	₱259,573.51
Contingent expenses	5,822.30
Cablegrams	188.76
Supplies expended	37,874.30
Paper expended	68,108.77
Printing and binding for printing bureau	6,067.45
Destroyed stock	1,703.55
Wear and tear of equipment	35,698.56
Allowance for maintenance of building	2,724.96
Total	417,762.16

The excess of production over the cost of production for the fiscal year is, therefore, ₱109,872.89, of which the sum of ₱69,572.15 was refunded to the bureaus as credits.

The value of the equipment of the bureau of printing, as per annual report of the director of printing for the fiscal year 1905, was ₱356,985.30, and deducting from this sum 10 per cent, or ₱35,698.53, for deterioration during the last fiscal year, leaves ₱321,286.77, which represents the value of the equipment at the end of the fiscal year 1906. There was purchased, however, during the fiscal year equipment to the value of ₱16,617.93, which added to the value of the equipment acquired in the fiscal year 1905 gives the sum of ₱337,904.70, the value of the whole equipment in use in the printing plant on June 30, 1906.

For further information and details see the annual report of the director of printing, attached hereto.

BUREAU OF COLD STORAGE.

Under the reorganization act the bureau of the insular cold-storage and ice plant was transferred from the department of finance and justice to the department of public instruction and the name changed to the bureau of cold storage.

On July 1, 1905, a contract was entered into between the insular government and Col. John L. Clem, assistant quartermaster-general, U. S. Army, under and by virtue of which the insular government leased for a period of one year to the United States 200,088 cubic feet of cold-storage space to be used by the Subsistence Department of the Army for the storage of fresh meats and subsistence supplies. For the space so leased the assistant quartermaster-general on the part of the United States Government agreed to pay 8½ centavos per cubic foot per month. The other terms and conditions of the lease are substantially the same as those of previous agreements entered into by the respective parties for cold storage.

On the 1st of July, 1905, the assistant quartermaster-general leased 42,418 cubic feet additional space to be utilized by the Subsistence Department for the storage and issuance of meat and such other supplies as might be required to be kept in cold storage. For this additional space the assistant quartermaster-general agreed on the part of the United States Government to pay to the insular government the sum of ₱2,500 per month. On the same date there was also entered into a contract between the same parties for the furnishing of ice to the Subsistence Department of the Army. Under the terms of this agreement the insular government agreed to furnish ice to the Subsistence Department not exceeding two-thirds of the capacity of the plant, and to deliver the ice either at the loading platform of the plant, at the wharf in front of the captain of the port's office, or at ship's side, as might be directed by the assistant quartermaster-general or his duly authorized representative. For the ice so delivered the assistant quartermaster-general agreed on the part of the United States Government to pay to the insular government 1 centavo per pound, payments to be made monthly at the office of the depot commissary in Manila.

During the period from July 1, 1905, to June 30, 1906, ice to the value of ₱138,067.22 was sold to the Army, Navy, and Marine Corps; to officers, civil officials, and employees, ₱99,474.83; to Government bureaus, ₱21,270.60; cash sales, ₱87,366.70; coupon sales, ₱53,742.15. Total cash sales of ice amounted to ₱399,921.50.

From July 1, 1905, to June 30, 1906, the bureau of cold storage received from the United States Army for cold-storage space, ₱234,089.76; from other persons for cold-storage space, ₱45,823.47; a total of ₱279,913.23. From the sale of distilled water the bureau derived an income of ₱23,774.70; from the sale of electricity, ₱6,616; and from other sources, ₱2,822.49. Total receipts from all sources, ₱713,047.92.

The total expenditures for the year amounted to ₱271,791.82, leaving a net balance of earnings over expenditures amounting to ₱441,256.10, a gain of ₱43,284.84 over the preceding year.

The gradual increase in earnings since the plant was installed and put in operation is shown by the following table:

For the fiscal year—	
1902	₱238, 100. 28
1903	267, 710. 68
1904	215, 748. 61
1905	397, 971. 26
1906	441, 256. 10
Total earnings	1, 560, 786. 93

During the year July 1, 1905, to June 30, 1906, a total of 39,309,900 pounds of ice was manufactured, of which 13,805,622 pounds were furnished to the Army, Navy, and Marine Corps, 9,356,610 to the officers of the Army and civilian officials and employees, 2,120,654 to government bureaus, 5,304,375 on coupons, 5,394,780 sold for cash. On July 1, 1905, there were on hand in the bureau 242,700 pounds of ice, which, added to the total manufactured during the year, gives a grand total of 39,552,600 pounds. Of this amount 35,983,041 pounds were sold. The wastage amounted to 3,295,959 pounds, and there remained on hand June 30, 1906, 273,600 pounds.

For further information and details see the annual report of the director of cold storage, attached hereto.

Respectfully submitted.

James F. Smith,
Secretary of Public Instruction.

To the Philippine Commission,
Manila, P. I.

EXHIBIT A.

REPORT OF THE DIRECTOR OF EDUCATION.

Department of Public Instruction,
Bureau of Education,
Manila, P. I., August 10, 1906.

Sir: I have the honor to submit herewith the fifth annual report of the director of education, covering the activities and expenditures of this bureau for the year ended June 30, 1906.

The last school term closed on Friday, March 30, 1906, and the current school year dates from Sunday, June 10, This report, in its school statistics, will be limited to the school term June 15, 1905–March 30, 1906, and for its summary of receipts and expenditures to the fiscal year ended June 30, 1906.

The last school year was the fifth since the organization of the bureau of education, act No. 74, creating the bureau, was enacted by the Philippine Commission January 21, 1901, and on September 1, of the same year the superior administrative authority over the bureau passed from the military governor of the Philippines to the secretary of public instruction. Thus a review of the past year's work is to some degree a summary of the results of five years' efforts, although back of this period lies at least a year during which schools were provisionally organized by military authority. This is the sixth annual report to be presented by the head of the bureau of education.[a]

LEGISLATION AFFECTING THE BUREAU OF EDUCATION.

The reorganization of government bureaus effected by act No. 1407, enacted October 26, 1905, occasioned no radical change in the bureau of education. It did, however, add to its personnel and to its responsibilities. The title of the chief executive of the bureau was changed from "general superintendent of education" to "director of education," and two assistants were provided, an assistant director of education and a second assistant director of education. The bureau of ethnological survey was abolished as a separate bureau and constituted a division of the bureau of education, known as the division of ethnology. Similarly, the American Circulating Library of Manila, which had previously been conducted by a board of trustees under the direction of the secretary of public instruction, was abolished as a separate office or bureau, and constituted a division of the bureau of education, known as the division of the American Circulating Library Association of Manila, Philippine Islands.

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[a] These reports are as follows: Report of Dr. Fred W. Atkinson, general superintendent of public instruction, to the secretary to the United States military governor in the Philippine Islands, published in the annual report of Gen. Arthur MacArthur, military governor of the Philippines, Manila, 1901, Vol. II.

Report of Dr. Fred W. Atkinson, general superintendent of public instruction, to the Hon. Bernard Moses, secretary of public instruction, for the year ending September 1, 1902; third annual report of the Philippine Commission, Part II, Appendix A, pp. 903 to 1004.

Report of Dr. David P. Barrows, general superintendent of education, for the period September 1, 1902, to September 30, 1903, made to Gen. James F. Smith, secretary of public instruction; fourth annual report of the Philippine Commission, 1903, Part III, pp. 694 to 923; published separately by the Bureau of Insular Affairs, Washington.

Annual report of Dr. David P. Barrows, general superintendent of education, to Gen. James F. Smith, secretary of public instruction, for the period September 15, 1903, to September 15, 1904; fifth annual report of the Philippine Commission, Part III, pp. 847 to 930; published separately, Manila, September, 1904.

Annual report of Dr. David P. Barrows, general superintendent of education, to Gen. James F. Smith, secretary of public instruction, for the period September 15, 1904, to September 15, 1905; published in report of the Philippine Commission for 1905, Part IV, pp. 403 to 616.

By act No. 1413, effective January 1, 1906, a change in school divisions was made by separating the province of Sorsogon from the province of Albay, and uniting with the former the island of Masbate, which had previously been a separate province and school division, to form the single province and school division of Sorsogon.

In the provinces of Mindoro, Palawan, Benguet, and Lepanto-Bontoc, the provincial governors have been, ex officio, school superintendents, but by act No. 1462, which became effective March 9, the director of education was authorized to appoint division superintendents for these divisions when, in his judgment, the interests of the service so required, who should relieve the provincial govenors of the superintendency of schools. In conformity with this act, acting division superintendents have been appointed for the provinces of Mindoro, Benguet, and Lepanto-Bontoc.

On October 4, 1905, by the passage of act No. 1401, division superintendents of schools were made members of the provincial boards, in place of the provincial supervisors, whose office was abolished. Membership on the provincial board has added considerably to the duties and responsibilities of the division superintendents. A large amount of their time has been taken in adjudicating disputed municipal elections. On the whole, however, I believe the measure a good one. The loss of time from school work is probably compensated for by the greater consideration given to school interests. The division superintendents bring to the task of provincial government a large amount of local knowledge, close sympathy with the people, and good judgment, results in nearly every case of relatively long and intimate acquaintance with Philippine affairs.

Several acts of legislation have had reference to the construction of school buildings. Act No. 1396, Section II "B," as amended, provides that plans and specifications for school buildings shall be prepared by the district engineers after consultation with the director of public works and with division superintendents, such plans and specifications being subject to the approval of the latter or of the director of education. It is further provided by act No. 1495 that the consulting architect "shall exercise general supervision over the architectural features of government constructions and of landscape gardening of public places of recognized importance." The same act authorizes the province to secure buildings for secondary instruction, either by building, purchase, or rental. In a number of past instances loans have been made by the insular government to provinces, to be reloaned to the municipalities for school construction. Act No. 1396 makes provision for provincial loans to municipalities of sums not to exceed 10 per cent of the gross receipts of the province for the year, to be used for the construction or repair of school buildings or for other school purposes. These loans, in accordance with the provisions of the act, are to be without interest, and must be repaid to the province not later than the end of the succeeding fiscal year in which the obligation is incurred.

In securing the permanent location of the provincial high schools, there has occurred much healthy rivalry between prominent towns of the same province. Municipalities have frequently bid for the high school by offers of sites and grounds, subscriptions of money, materials, etc. In a number of cases municipalities have offered to convey without consideration lands belonging to the municipality or township. There was found to exist in law, however, no authority for a municipality to expend public funds or to donate municipal lands for provincial purposes, and to legalize this proceeding, act No. 1492 was passed, empowering municipalities to transfer to the provincial authority sites for the erection of provincial schools.

Division superintendents and supervising teachers have at times experienced great difficulty in hiring horses for their work of inspection. Frequently the only reliable method seems to be that the superintendent or teacher shall own his transportation. Act No. 1416 provided for a monthly allowance of ₱20 or less to such division superintendents and supervising teachers as are obliged to own their own horses in order to do their work of inspection.

The Philippine Medical School was created by act No. 1415, its control being lodged in a board consisting of the following members: The secretary of public instruction, the secretary of the interior, one member of the Philippine Commission, and one other member to be designated by the governor-general. By provisions of the act, other bureaus are authorized to loan supplies and detail employees for assisting the work of the school. The bureau of education is further cooperating by preparing students for entrance to the medical course. The first and second preparatory classes are at present under instruction in the Philippine Normal School, and the first class, consisting of 20 members, will be ready to enter the first year of the medical course upon the opening of the school, which will probably be in June of next year.

Provision for juvenile offenders was made by act No. 1438, whereby all minors who are offenders against the law may be committed to the custody of any orphan asylum, reform school, charitable society, or society for the prevention of cruelty to children, or to any other charitable or educational institution having for its object the betterment, reform, or education of minors. The Hospicio de San José, a charitable institution under the jurisdiction of the archbishop of Manila, is, so far as is known to this office, the only institution that has provided for the reception of such offenders. About fifty children, mostly boys, have been so far committed to this institution and are being cared for and educated.

Act No. 1455 suspended the land tax in the Philippine Islands for the calendar year 1906, and in lieu thereof provided for reimbursement, out of insular funds to provinces and municipalities, the amount of land tax collected in the previous fiscal year.

RECEIPTS AND EXPENDITURES FOR PUBLIC INSTRUCTION.

Public instruction in the Philippines is maintained out of three sorts of public funds: The appropriation of the insular government for the bureau of education; appropriations by provincial boards for provincial high schools and in some cases for intermediate schools, and appropriations out of municipal funds for the support of primary schools. No tuition of any kind is charged in any school where the teacher is paid out of public funds. Insular expenditures for the bureau of education have been somewhat augmented the past year, mainly by reason of the transfer to the bureau of education of the ethnological survey and of the American Circulating Library, above noted, and also by including in the disbursements of the bureau of education the expenditure on account of government students in the United States. The annual appropriation bill for the fiscal year ending June 30, 1906, provided the sum of ₱2,900,000 for the bureau of education. The total expenditures out of this sum to June 30, 1906, amounted to ₱2,880,047.68. This is the largest sum ever expended by the bureau of education in any one year.[a]

The expenditure of the amount of ₱2,880,047.68 was distributed under the following items:

Office of the director of education	₱79, 466. 76
Salaries of division superintendents	122, 153. 53
Salaries of clerks to division superintendents	30, 350. 13
Salaries of American teachers	1, 745, 064. 72
Salaries of Filipino insular teachers	181, 803. 96
Wages of night-school teachers	2, 436. 00
Salaries in division of ethnology since November 1, 1905	8, 286. 64
Salaries in American Circulating Library since November 1, 1905	5, 122. 66
Wages of other employees of the bureau	4, 372. 22
Purchase of school books and supplies, including equipment, machinery, and tools for industrial departments of intermediate and high schools, furniture and supplies	412, 170. 08
Other incidental expenses, including postage, telegrams, printing, and binding	11, 890. 09
Transportation expenses of officers and employees of the bureau, including transportation of supervising teachers	61, 259. 30
Rental of buildings	9, 000. 00
Transportation of supplies	6, 873. 23
Aid furnished the towns of Cavite Province for the support of primary instruction	13, 877. 68
The education of Filipino students in the United States	185, 920. 68

The total expenditure for salaries and wages was ₱2,179,056.62, and for all contingent expenses ₱700,991.06.

PROVINCIAL EXPENDITURES.

Provincial expenditures for support of secondary education show a gratifying increase over last year. There are 33 Christian provinces in the archipelago whose financial administration is typical. These provinces expended during the year ending June 30, 1906, the sum of ₱225,159.44, nearly three times the sum spent in the previous year, which was ₱78,918.40. The larger portion of this amount was paid for construction of high school buildings in the provinces of Albay, Bulacan, Oriental Negros, Romblon, Sorsogon, Tayabas, Iloilo, and Bohol. This figure includes

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[a] The expenditures were for the fiscal year—

1905	₱2, 402, 733. 46
1904	2, 488, 192. 00
1903	2, 801, 126. 00
1902	2, 388, 762. 00
1901	466, 822. 00

expenditures from provincial revenues only and does not include additional sums expended on these buildings which came from private donations, nor the amounts furnished by the bureau of education from the appropriation provided by act No. 1275. Neither does the above include sums appropriated or made available by provincial governments which have not yet been expended.

Next to building construction the largest item of provincial expenditures was for rental of buildings occupied by high and intermediate schools; then follow other expenditures, as furniture, supplies for shops, supplies for domestic science instruction, janitor service, office supplies and in some cases rental of the division superintendent's office. In a few cases also teachers of Spanish and industrial work are being paid by provinces, but the teaching force in high schools, with these few exceptions, is paid by the bureau of education.

The provinces of Mindoro, Palawan, Lepanto-Bontoc, Benguet, and Nueva Vizcaya are exceptional in their system of taxation. In Benguet and Lepanto-Bontoc the population is overwhelmingly pagan (Igorot); in Nueva Vizcaya, largely so. In Palawan it is pagan and Mohammedan as well as Christian. In Mindoro the Christian population, while predominant, is sparse and poor, and as a result the province is not self-sustaining. None of these provinces collect the land tax and the provincial governments are sustained by appropriations made by the Commission out of insular funds. From these funds Nueva Vizcaya spent in support of its high school ₱330; Mindoro and Palawan have not reported any expense of this nature; Benguet and Lepanto-Bontoc expended for industrial schools for Igorots ₱1,833.06 and ₱2,913.95, respectively.

In the Moro Province all school expenses, including salaries of Filipino teachers and salaries of American teachers, are paid out of the provincial revenues. For school purposes the government of the Moro Province appropriated during the last fiscal year ₱139,465, of which ₱135,000 was expended. Adding this last sum to the others above mentioned we have a total of provincial expenditures for the archipelago of ₱365,236.45.

MUNICIPAL SCHOOL FUNDS.

Municipal school finances call for special attention, as upon them rests the entire system of primary instruction. With a very few exceptions all teachers in primary schools during the past year were municipal teachers (Filipinos), appointed by the division superintendents but paid from municipal school funds. Out of the municipal funds likewise are paid all expenses of construction and repair of buildings, rentals, furniture, janitor service, transportation of school supplies, etc., the bureau of education supplying, as formerly, all school supplies (except furniture), and paying the corps of supervising teachers and their traveling expenses.

Receipts of municipal school funds in all provinces, except Benguet and Palawan, amounted for the year to ₱1,960,018.68, of which amount there was expended ₱1,364,130.40; and unexpended balances on hand at the commencement of the new fiscal year, July 1, amounted to ₱595,888.28. While there was no province in which the receipts of school funds did not exceed expenditures and obligations, this would not hold true of all municipalities in the island, there being some which closed the year without funds to pay all obligations incurred. But these towns, outside of the island of Cebu, are few in number, school finances as a rule being in excellent condition and still showing a substantial increase from year to year. (Municipal school funds in the fiscal year 1904 amounted to ₱1,016,303 and in 1905 to ₱1,797,547.67.)

This satisfactory condition of school finances is largely due to the good business management of the division superintendents, who have distinguished themselves by watchfulness over expenditures, close economy, and ability to make small sums go a long way. The increased income is attributable in large part to the 5 per cent of internal-revenue collections and the development of this branch of the fiscal system, and also to the liberal appropriations made by municipal councils from general funds to school funds.

TOTAL EDUCATIONAL FUNDS.

Adding together these several kinds of contributions, insular, provincial, and municipal, we have as a total of revenues provided for public instruction ₱5,229,720.13, of which total there was expended ₱4,609,414.53.

These figures do not, however, take account of voluntary contributions made by private individuals, usually for new school buildings. Owing to incomplete reports no exact statistics can be given for the entire archipelago this year. For the previous fiscal year these gifts aggregated ₱232,988.33. During the last school year probably more has been given toward high school buildings, but less for barrio schools, than in 1905.

The above is an average expense per capita for education of about 61 centavos. The expenditure per capita of population for public schools in the United States, while differing much in different parts of the Union, averages for the whole country about $3. It is evident, however, that comparison can not be profitably made between the United States and the Philippines. On the contrary, it is suggestive to compare the Philippines with Japan. In this latter country there was expended in the year 1902-3 a total of 51,177,029 yen, or about 1.11 yen per capita of population, rather more than double the rate of expense in the Philippines.

PUBLIC INSTRUCTION GIVEN DURING THE PAST YEAR.

The number of primary schools, exclusive of the Moro Province, increased during the past year to over three thousand, there being 3,108 open in the month of March, the last month of the school year. In the Moro Province the number of primary schools increased from 52 to 58, including two trade schools of primary grade. Adding these 58 gives a total of 3,166 primary schools for the islands, an increase of 439 primary schools since March, 1905. The number of Filipino teachers likewise increased from 4,457 to 4,719 (including 324 insular teachers), and in addition to these teachers a large number of "aspirantes" or "apprentice teachers" taught during the year, there being 1,442 reported as employed in the month of March. In some cases these apprentice teachers received nominal pay, but in most cases their services were unremunerated, except by the privilege of attending teachers' classes and institutes. In the Moro Province the number of primary teachers was 63, making a total of 6,224 Filipino teachers and aspirantes giving instruction in the last month of the school year.

In the last annual report attention was called to the fact that the enrollment in primary schools had greatly exceeded the facilities available for instruction, and that superintendents had been directed to exclude not only children below the age of 6, but if necessary to make the age of entrance 8 to 9 or even 9 to 10 years, to insist upon regularity of attendance, and to try to improve the quality of the instruction rather than to increase the enrollment. This policy has been followed this year with excellent results. No account has been taken of total enrollment, the whole attention being put upon monthly attendance. October is the best month for school attendance, but the month of March is selected for statistics herein given as the last of the school year and as furnishing the latest data in point of time. For the month of March there were in the primary schools 365,333 pupils, of whom 220,484 were boys and 144,849 girls, the proportion between the sexes being as 60 to 40. The average percentage of attendance in all provinces for the month of March was 85.2, the best attendance being obtained in the city of Manila, where it was 95 per cent, with Union and Tarlac both 94 per cent.

As regards intermediate instruction, in addition to the provincial high schools, 36 in number, each of which maintains an intermediate preparatory department, there were 92 schools giving intermediate instruction. The total attendance of pupils in intermediate classes, including provincial high schools, was, in the month of March, 9,120, of whom 7,018 were boys and 2,102 girls, a proportion of 77 per cent to 23 per cent, besides 59 intermediate grade pupils in the Zamboanga high school (Moro Province). The daily attendance of these schools is excellent, being a percentage of 96 per cent. Five provinces in the month of March reported that there had not been a single absence from school of an intermediate pupil. These provinces were Camarines, Cavite, Union, Occidental Negros, and Palawan.

As regards secondary instruction, 17 provinces last year had high school courses. These provinces were Ilocos Sur, Bulacan, Cagayan, Laguna, Nueva Ecija, Nueva Vizcaya, Pangasinan, Romblon, Surigao, Tayabas, Leyte, Union, Iloilo, Ilocos Norte, Cebu, Cavite, and Batangas. The total March enrollment in these secondary classes was 308 students, of whom 245 were young men and 63 young women, a proportion of 80 to 20 per cent.

The disparity in numerical attendance of girl students in the intermediate and secondary courses is rather marked; nevertheless, some of the very brightest students are young women. The highest marks in competition for appointment as government students in the United States in two successive years have been obtained by young women. The percentage of attendance among these high school students was most excellent, being 98 per cent in the month of March. Nine of these 17 schools, in the month of March, did not have a single absentee secondary pupil.

The Philippine Normal School had in attendance in the month of March, 357 students, 245 of whom were young men and 112 young women, besides 119 pupils in its training school; the Philippine Nautical School, 21 students, young men, and the Philippine School of Arts and Trades, 237 young men.

These figures give a total attendance of pupils in all public schools for the month of March, 1906, of 375,554, which total may be compared with a similar total of 311,843 pupils for the month of March, 1905.

All of the school divisions conducted teachers' institutes last year, varying from four to six weeks, in different provinces. In most cases admission to these institutes was permitted only to actual teachers and "aspirantes." The instruction given was divided between the common branches of the intermediate course and special topics of instruction, such as school gardening, domestic science, primary industrial work, and methods of teaching. The regular daily and weekly instruction of Filipino teachers by the supervising teachers was also continued. These two means of developing the Filipino teacher commend themselves more and more, and there is no immediate prospect of their discontinuance.

A vacation assembly for American and Filipino teachers was held in Manila, on the grounds of the normal and trade schools, from April 9 to May 18, and was attended by 186 American and 384 Filipino teachers. Courses were given in a large number of subjects. The first assembly or summer school was a decided success, and strongly recommends the continuance of the plan every year.

THE TEACHING FORCE.

American teachers under regular appointment on duty during the last school year numbered 763. The appropriation authorized 800 American teachers, but did not provide an appropriation large enough to employ so many. This force was augmented by the appointment from time to time of 68 teachers under temporary employment. As regards the American teaching force the following facts may be of interest: The average salary of the regular American teacher was ₱2,181.33. Of all teachers, regular and temporary, 574 were men and 257 were women; of these teachers 143 had been in the service less than one year. The bureau suffered the loss, by reason of death, of 4 teachers. There were 83 separations, of which 14 were transfers to other branches of the Philippine service, and 7 were dismissals for cause. Health conditions among the American teaching force apparently continue about the same. During the forty weeks of the school year the force of American teachers averaged a small fraction over three days of illness as against three days for the previous year.

Regular teachers are obtained by appointment by the director of education from eligible lists certified by the bureau of civil service, as the result of competitive examinations held in the United States and in the Philippines. A total of 215 men and 107 women were so certified during the past year, and of this number 110 men and 27 women were appointed and accepted. This method of obtaining teachers is satisfactory except for special instructors as of science, agriculture, and the trades. These classes of teachers, who are greatly needed, seem to seldom enter the examinations.

The appropriation bill carried 294 positions for Filipino insular teachers, but by splitting positions (a measure permissible by executive approval) a considerably larger number of such teachers have been employed. In March there were 324 engaged. Eligibility for permanent appointment to those positions is obtained by civil-service examinations. A fairly large eligible list now exists, though it is not evenly distributed in the different provinces. This office has recommended that the standard of this examination be raised to an equal grade with the school examination for the completion of the intermediate course. Insular teachers have been assigned to various duties; a few have been supervising teachers, and in this capacity have given good satisfaction. Some have been teaching intermediate grades, but the majority have served as principals or Grade III teachers in central municipal schools. Of the 4,395 municipal teachers who had regular appointments, 3,015 were men and 1,380 were women. They are for the most part young (835 are under 18 years of age), educated largely in schools established since American rule, and sprung from the poorer classes as well as from the well to do. In fact all grades of society are represented. Their average compensation, instead of raising, as was anticipated, has decreased and now averages ₱18.01 per mensem for men teachers, and ₱17.62 for women teachers, where two years ago the figures were ₱20.76 per mensem for men, and ₱20.99 for women. This does not, however, indicate that the service is less well paid, but rather that the standard has gone up, and it has become possible to secure new teachers whose training and experience are small at lower salaries than before. Service in the bureau of education carries with it valuable educational advantages which have come to be appreciated, and which are a strong attraction to enter the service and to accept a modest compensation during the first year or two of teaching. A year ago it was anticipated that the instruction given to Filipino teachers would carry the large body of them so far forward as to eliminate teachers of a lower standard of attainment than Grade IV. This result, however, has by no means been reached. In part this is due to more vigorous examinations and higher standards. The reports for March showed that there were 1,862 teachers who had not successfully passed the primary examination. Of the rest 1,222 were classified as belonging to Grade IV, 725 to Grade V, 281 to Grade VI, and 24 in the secondary course. The average of the insular teachers is naturally much higher. In a number of divisions it has been possible to adopt the rule that no one who has not passed the primary examination shall be given a teacher's appointment.

SCHOOL BUILDINGS.

Of the provincial schools, 13 are accommodated in buildings owned by the provincial governments, and either specially constructed or purchased within the last three years for high school use. These buildings are 19 in number, and include shop as well as central recitation buildings. There are 30 buildings rented by the provincial governments for high school purposes, and in addition a number of buildings belonging to the provinces, but not constructed originally for school purposes are used. The high school of the city of Manila, which opened June 11, 1906, occupies the former escuela municipal. In addition to these there are actually under construction 17 buildings designed for high school use, which include central recitation buildings, shop buildings, and dormitories for students. These latter buildings are being constructed in part out of funds appropriated by the insular government, in part by provincial appropriations, and to a considerable degree from funds provided by private subscriptions.

Of intermediate schools only two are accommodated in buildings specially designed for this purpose. One is the intermediate school at Indang, Cavite, and the other the intermediate trade school at Bacolor, Pampanga. Other intermediate schools are accommodated either in central municipal school buildings, in rented buildings, or in government buildings not designed for the purpose and temporarily loaned.

There are 2,454 primary school buildings owned by municipalities. In the destructive typhoon that visited the archipelago in September a large number of school buildings were destroyed, which have, however, been more than compensated for by the construction this year of 298 new primary school buildings. While the majority of these are barrio schools and are in part of light materials, they are of a more substantial character than those which were being put up two years ago.

ESTIMATE OF THE YEAR'S WORK.

The past year has undoubtedly been by far the most successful in the history of the bureau in the accomplishment of substantial results. More pupils have been taught than ever before and the instruction has been much better. The regularity of attendance, especially as the higher grades are reached, argues well for the establishment of new habits and for the solidity of the instruction. The number of new schools opened is naturally not as great as in the two previous years, when the work of the bureau was undergoing a rapid development, but the growth is apparent, and these last schools have been established with particular reference to permanency.

Advance is noticeable among the Filipino teachers. The system of classification introduced among them has been followed by a greater definiteness in their instruction. These teachers continue to gain in reliability, strength of character, and moral purpose. The production of such a force, numbering as it now does over 6,000 including apprentice teachers, still impresses me as the most striking result effected by the bureau of education. American teachers must, necessarily, come and go, but this force of Filipino teachers, continually gaining in learning, maturity, and character, understanding more and more clearly the character of their mission, and becoming continually more devoted to it, is coming to be the best and most influential force in the life of the islands.

The great mass of public school pupils, as has already been sufficiently well indicated, are children of the poor or lowest classes. What will public instruction do for them? Will it,as we hope, make them independent producers, skilled workmen, intelligent citizens of their towns, free them from debt, raise their standard of life, and elevate their moral character? This is the final test of the serviceability of education; the standard by which this system of public instruction must in the end be judged. I must admit that whether or not the public schools will do all this, we can not yet say. It may already be satisfactorily shown that the public schools can turn out competent teachers, clerks, and aspiring students, but whether they can make the masses intelligent, industrious, economical, and upright is a question which will take some years of further progress to demonstrate, and argument either for or against such hopes is at the present time mostly futile.

PRIVATE SCHOOLS.

Private instruction plays a large part in the intellectual life of the islands. While not amounting to a complete classification, these private schools may be grouped in three classes:

First, there are institutions of secondary instruction, usually, but not always, supported by the Catholic Church, and many of them with a history reaching back several decades. The instructors in the institutions are in large part members of religious orders. Such institutions exist not only in Manila but in several provincial capitals, particularly those which are Episcopal sees. Judging from such information as I have and from the character of students from these institutions, who frequently apply to the bureau of education either for further instruction or for other purposes, I should say that the instruction in these institutions was undergoing considerable development. English has been introduced into most of them and in some cases is well taught. My impression would be that the support given these schools is not much affected by the existence of public schools.

In the second place, private schools or "colegios," sometimes unduly pretentious in their announcements, exist in a great many large towns. They usually offer secondary education, including Latin, but give primary instruction as well; some of them promise to confer degrees. Some of them teach English, although in practically all of them Spanish is the basis of instruction. These schools are usually organized by ambitious young Filipino scholars and often secure considerable local support. Not possessing large resources nor the prestige of past services, they are seriously interfered with by the presence of public high schools or intermediate schools. These schools, while not at present of a high type of efficiency, in the future as the standards of education rise and the qualifications of private teachers improve, may become an effective element in the progress of the people. The instruction, while too pretentious and not sufficiently thorough, is by no means without its results upon the minds of the pupils.

The third class of private school is the primary school, usually conducted in the native dialect of the locality, and designed primarily to give small children the rudiments of religious instruction and preparation for their first communion. Sometimes these schools are under the direction of the parochial "cura," and are held in the convent; but quite as often they are held in private houses. Sometimes the teachers are men, or more frequently women, who were public school teachers in Spanish times, but who did not make the degree of progress necessary to continue under the present government. There are hundreds of these schools all over the archipelago. Children sometimes leave the public schools for a few months in order to receive in them the religious instruction which is not provided in public schools. It can not be stated, however, that these schools are well conducted. The order is poor. Children receive little attention from the teacher, who is frequently occupied with other things, such as household duties, and, if attendance at these private schools prevented the child's getting the education of the public schools, their presence would be considered regrettable, but the fact is that an adjustment between the work of the public schools and these private schools seems to be gradually taking place. The crowded attendance in the public schools makes it necessary more and more to exclude from attendance children under 8 or 9 years of age. The years from 9 to 12 are believed to be the best for attendance at a public primary school. The child is more matured and better able to undertake the learning of a new tongue; leaving the primary school at from 12 to 15, he is also much more likely to make use of the language and instruction therein obtained than if he left at 10. It would then seem that there is a period in the life of the child, say from the age of 6 to 9, in which private instruction may be cordially invited. In a single year of instruction the child could be taught the alphabet and the syllabary necessary to read a native tongue, and, in addition, if the school was a church school, receive religious instruction embracing a simple exposition of Christian faith, prayers, songs, and Christian morals. It might be further remarked, however, that the task imposed upon the church of giving elementary religious teaching would be a far simpler one than that imposed on the government in giving three years of primary instruction, inasmuch as where the primary schools must attempt to reach 400,000 pupils these doctrinal schools could be content with a third of the number, as the instruction need last but one-third as long; and, while the public schools must have native teachers sufficiently trained in English to give three years' satisfactory English instruction, the doctrinal schools would require no such standard of their teachers.

During the past year the clergy, particularly the native curas, have continued to be friendly supporters of the schools. The only part of the archipelago in which there has been reported religious opposition is in the Moro Province, where the superintendent reports very active opposition on the part of the Jesuit missionaries. In the northern provinces of Mindanao the public schools seem to have fully won the confidence and support of the people, and the attitude of the Jesuit missionaries has become friendly. Some advantage is taken by priests of the opportunities for instruction of public school pupils under the provisions of section 16 of act No. 74, and in some places this seems to be a satisfactory arrangement. It is not, however, generally taken advantage of.

There is another field in which the Catholic Church as well as various missionary societies are commencing to cooperate with the work of public education. This is by establishing private dormitories for students attending provincial high schools and schools in Manila. This has been done in several provincial capitals, and for students attending the Philippine Normal School a dormitory has been opened by the archbishop of Manila. There is a great field for such enterprise and many such student homes are needed, in addition to such public dormitories as have been opened. These institutions have, of course, no official relation with the public schools, whose students they shelter, nor with the bureau of education, but in view of the homeless and unprotected life of hundreds of our young men students, their presence is welcome.

ENGLISH AND THE NATIVE LANGUAGES.

Supervising teachers generally become familiar with the native language of their district and find this knowledge of great assistance to them in their work among the people. It is never used in the public schools even by the Philipino teachers. English is taught, even to the small beginner, without the assistance of translation, the first steps of the pupil in chart and primer being so arranged as to obviate its employment. This method, which is that most commonly in vogue among teachers of foreign languages, receives the overwhelming indorsement of American superintendents and teachers. There are some, however, who advocate modifications of this method, and their criticisms are sufficiently intelligent and thoughtful to demand consideration.

As far as the people of the provinces are concerned the demand for instruction in English has continued to increase, and is at the present time practically unanimous.

Recently certain Filipino writers in Manila have viewed the teaching of English with some alarm. They see in it a menace to the "Filipino soul," and argue that knowledge of English will "Saxonize" the Filipino people.

The history of other peoples, however, does not justify the belief that the adoption of English speech will result in making over the race to conform to artificial standards. Mexico might be mentioned as a country where Spanish speech has spread among the Indian population without destroying the best native elements of its character. I suppose no one would argue that Mexico would be better off to-day if Spanish were not the universal medium of communication and the native Indian languages had continued to be the only idioms spoken by the great mass of the population. It is, however, the choice of the Filipino people which must eventually decide this matter and this is at present overwhelmingly in favor of English instruction. One of the native papers of Manila in speaking of the recent criticisms of the teaching of English, said: "Against all the arguments that can be opposed to the teaching that is given in the public schools, there exists one that is irrefutable—the school attendance."

RECOMMENDATIONS.

There seems to be little to recommend in the way of immediate changes. No additional legislation is asked for except a law already under consideration by the Commission which will authorize municipalities to subscribe to the expense of provincial schools.

The only doubtful feature of the system of instruction seems to be the intermediate schools. Our original programme of 120 such institutions, an average of three to a province, has not been possible because of inadequacy of funds. The bureau of education is supplying the instructors for these schools and the insular government is not now providing enough money to enable it to do so in all cases demanded. It seems probable that the development of intermediate schools will have to wait upon a class of Filipino teachers capable of giving this instruction, and upon the increase of local revenues, either provincial or municipal, to the point where they can support them. It may be better to plan for fewer intermediate schools and to modify the primary course so as to give a fourth grade of instruction in all central municipal schools. This is a plan which will be tried in the next year or two. Under this plan special schools giving the instruction of Grades III and IV should exist in all municipalities. The teaching should be limited to the third and fourth grades, leaving the first and second grades to the barrio schools, and it should be of an eminently practical kind, designed to fit the boys and girls for comfortable, respectable, healthful lives in their own towns. It should aim not only to complete the pupil's practical familiarity with English, with business arithmetic, and with elementary geography, but should also add instruction in agriculture and tool work, such as handy carpentering, blacksmithing, stone and brick masonry, and the use of cement, whitewashing and painting. It should also, identify the pupil with the life of his town, its improvement, sanitation, and political activity. For the girls it should embrace two years of housekeeping, cooking, care of infants, nursing, and sanitation. Such schools as these can not be started until we have a class of Filipino teachers who are trained not merely in the academic branches necessary but in the practical subjects as well. This problem is, however, being seriously attacked, and in one province, Pangasinan, there is this present year under instruction a teacher from each of 30 towns, who will spend the entire year in the provincial capital preparing to teach such subjects as above are outlined. It may be that the establishment of such schools as these, which shall complete the instruction of the great mass of the people, and apply it to their needs, will be the solution of our problem of making education the transforming factor in the social and economic life of the nation.

DIVISION OF ETHNOLOGY.

The chief of this division, Dr. Merton L. Miller, has been largely occupied during the past year in visiting different non-Christain tribes and securing information for the secretary of the interior that would assist in settling administrative questions having to do with these peoples. He visited the Bukidnon of Misamis Province, the Negritos of Tarlac, Zambales, Bataan, and Pampanga, and the Negritos and Ilongot in Nueva Ecija and Infanta. The assistant ethnologist, Mr. Christie, has spent most of the year prosecuting field studies among the Subanon of Mindanao.

In February the offices of this division and the ethnological exhibit returned from the St. Louis Exposition, were moved into the same building with the other offices of the bureau of education. This ethnological material is considerable in quantity and, for certain tribes of the Philippines, and fairly complete. It, unfortunately, was returned from St. Louis largely unlabeled, and a large amount of work has been necessary in order to identify and label the specimens. They are now in part being arranged for display.

Three volumes of publications appeared during the early part of the year: The Nabaloi Dialect, by Otto Scheerer, and The Bataks of Palawan, by Lieut. E. Y. Miller; Relaciones Agustinianas de las Razas del Norte de Luzon, edited by F. Angel Perez; and studies in Moro History, Law, and Religion, by Dr. N. M. Saleeby.

The Commercial Museum, formerly in charge of the bureau of the ethnological survey, was by executive direction discontinued and its affairs have been wound up, its exhibits being returned to exhibitors or disposed of according to their directions.

THE DIVISION OF THE AMERICAN CIRCULATING LIBRARY OF MANILA.

This library was transferred during the month of March to the same building with the bureau of education, and occupies the entire western end of the building. Since this removal the library has been open continuously from 8 in the morning until 10 at night each day of the week except Sundays and holidays. The number of subscribers increased from 290 in April to 430 in June. The number of volumes drawn out per month is now about 1,400, of which 1,100 are fiction. The number of volumes on hand June 30 was 12,482. Receipts from subscribers' cards and fines amounted to about ₱230 per mensem, and constitute a fund which is expended net for new books and periodicals. A balance of ₱3,200 was on hand at the end of the fiscal year. About 1,000 new volumes in the subjects of history, travel, administration, and political economy have lately been ordered, and important additions have been made to the list of periodicals. The periodical list with recent additions embraces 108 current publications. This by no means, however, exhausts the reading facilities offered through the library. There are also available the exchanges received by the division of ethnology for its publications, which amount to 152 American and foreign publications. There is also a large list of trade journals from all parts of the world formerly received by the Commercial Museum and now coming to the bureau of education, which number 63. In addition to these, 20 publications devoted to science and education are received by the bureau of education, which are likewise available for the public. The whole constitutes a wide range of periodical reading matter available at all times to the public. An effort is likewise being made to form a library of Philippiniana and a special room has been set apart for such collections, to which admission may be had upon application.

Much progress has been made in the last few months toward cataloguing the library. Over 12,000 volumes have been accessioned, had pockets attached, and book cards prepared; 4,480 volumes were book numbered, classified, and labeled, and 4,350 volumes had catalogue slips written. This entire task will be pushed forward to completion. The present aim is to make the library thoroughly cosmopolitan and to build up sections in foreign languages as well as English, so as to appeal to the several nationalities resident in the city of Manila. The present patronage is considered very satisfactory, and is steadily increasing.

Very respectfully,

David P. Barrows,
Director of Education.

Hon. W. Cameron Forbes,
Acting Secretary of Public Instruction, Manila, P. I.

EXHIBIT B.

REPORT OF THE PURCHASING AGENT.

MANILA, P. I., *August 21, 1906.*

SIR: I have the honor to transmit herewith the annual report of the bureau of supply for the period from July 1, 1905, to June 30, 1906.

As this report is largely statistical in explanation of the accounting, I quote from the subreport of the acting disbursing officer and cashier, Mr. J. W. McFerran:

"It will be seen that this report is divided into three parts, principally for the sake of convenience and ready reference, the first comprising a compendium of the operations of the bureau as conducted along methodical lines of accounting invariably adhered to by up-to-date commercial establishments, and consisting of the least amount of data possible to a complete and comprehensive understanding of the true condition of the business and financial affairs of this institution as a whole. The 'general statement of assets and liabilities' is to a considerable extent supported by brief supplemental statements, all of which are considered essential to the completeness of the report and explain adequately just how the business has been conducted during the period of the fiscal year which the report covers. Every item appearing in connection with these statements can be readily verified by reference to books of permanent record in this office, all of which books are replete with such statistical and bookkeeping data as is absolutely necessary to enable a true condition of the business to be determined at any time. The system of accounting in vogue is thorough and complete in every particular, which gratifying condition can largely be attributed to the fact that the work is being handled by a competent and energetic set of clerks, most of whom have had considerable experience both in government and commercial affairs, making them in a sense indispensable to the successful operation of the office.

"The second part of this report deals exclusively with the sales and settlements derived therefrom, and covers in detail all of the business coming under the administrative supervision of the undersigned in his capacity as cashier. The sales of supplies in connection with the commissary supply store are included in the total sales of the bureau, as is shown by the detailed statements of such sales, but the commissary business is shown separately—sales, purchases, etc.—in general statements in connection with this report.

"The third and final part of this report, as will be seen, consists of several detailed statements showing all disbursements made by this office, including the disbursements made by the disbursing agent, Washington, D. C., in payment of supplies purchased for and on account of this bureau in the United States during the period covered by this report.

"Among the assets and liabilities, as shown in the 'general statement of assets and liabilities' embodied in this report, there appear a few items which have been pending adjustment for some time. The first is the item of ₱23,245.94 which is being carried on the books of this office as an asset, principally on the strength of the interpretation of that part of act No. 1361 which relates to this bureau. It would appear from the wording of the act in question that certain of the administrative expenses of this bureau covering the fourth quarter, fiscal year 1905, were to be paid out of available funds appropriated by act No. 1225. These expenses, however, aggregating as above stated, the sum of ₱23,245.94, in the absence of a definite understanding in the premises, were to promptly meet the emergencies of the occasion, paid out of 'purchase of supplies' appropriation, and this office being still of the opinion that such funds should have been permanently withdrawn from act No. 1225 to cover said expenses, requests that recommendation be made with a view to having the amount involved refunded to 'purchase of supplies' appropriation. If this amount is not allowed, naturally a corresponding diminution will be effected in the surplus account.

"In reference to the item of ₱20,746.67, which constitutes a proper charge against the 'Congressional relief fund,' and which was paid out of the 'purchase of supplies' appropriation to cover the cost of a certain quantity of galvanized-iron roofing furnished to the inhabitants of various provinces throughout the islands for the purpose of relieving distress, etc., caused by locusts, it would appear, in view of the long time settlement has been pending, that exceptional measures should be resorted to in order that this long outstanding obligation may be liquidated.

"The other items which this office is desirous of having adjusted at the earliest practicable date also appertain to 'Congressional relief funds,' and have been carried on the books of this office for an exceptionally long period, unsuccessful efforts having been made on various occasions to effect their proper adjustment. The items involved are the last three appearing in the column of assets in the 'general statement of assets and liabilities' and aggregate ₱29,045.22, covering payments made out of the 'purchase of supplies' appropriation for the care and maintenance of carabao, there being no funds available and specially set aside at the time for this purpose, and as such expenditures were consistent with the needs and requirements of the service, 'purchase of supplies' funds were drawn upon in anticipation of favorable legislative enactment providing for reimbursement. This action, however, has never been accomplished, and in view of the foregoing circumstances it is again urged that the necessary course of procedure be adopted with a view of bringing about the final adjustment of the amounts involved.

"In addition to the above there is an item of ₱69,836.32 representing a liability and carried as such on the books of this office. This amount is due 'Congressional relief fund,' on account of rice taken over and disposed of by sale in the regular way, and as payment to cover this rice has been made and erroneously applied to the credit of 'purchase of supplies' appropriation, it would seem to be incumbent upon this bureau to arrange for an early adjustment of the matter."

PURCHASE OF SUPPLIES.

There has been from time to time during the past year newspaper criticism of the action of this bureau in ordering supplies in the United States. Reference to Exhibit D shows that the purchases in Manila amounted to ₱2,356,055.71, and the total for the United States, ₱978,981.36. Of this amount ₱182,149.86 was paid to Mr. W. W. Robinson, Seattle, Wash., by the bureau of insular affairs for hay and grain on the old contract, which for three years has been handled direct, but is now, under the new arrangement, paid for in Manila. ₱272,257.94 was paid by the bureau of insular affairs for school books for the bureau of education, upon which amount agents in Manila are supposed to have received commissions. ₱59,755.40 was paid for supplies and machinery for the bureau of printing. The majority of goods so purchased are at practically the same prices as are paid by the Government Printing Office in the United States. The machinery, etc., ordered for the bureau of printing, in the nature of additions, repairs, and replacements of the original plant, are purchased to better advantage by our own agent, who has access to and may consult officials of the Government Printing Office in Washington in detail in the matter of these supplies.

Summary.

Total value of supplies purchased in Manila during fiscal year 1906	₱2, 356, 055. 71
Total value of supplies purchased in the United States	978, 981. 36
Total amount expended for hay and oats, school books, etc., and printing supplies	514, 163. 08
Amount expended in the United States for miscellaneous supplies	464, 818. 28

Thus it will be seen that 81 per cent of the purchases were made of Manila merchants and agents.

Many cases arise where it would be folly to give orders to local firms; for example, medicines, inks, glassware, and crockery, where there is a chance for great loss by breakage, and in "rush" orders, which necessitate cabling the order. In the first case the merchant charges a higher price to protect himself against loss by breakage while the government is absolutely protected by the insurance policy. No matter how great or small the damage, cause not considered, the government is paid therefor by the insurance company, hence we have no losses of this nature. In the second instance, if we place "rush" orders with local firms they must pay twice the cable rate paid by the government, a higher freight, insurance, and lighterage rate, a commission of at least 2½ per cent to their New York agents, interest and exchange at from 4 to 7 per cent on the cost of the goods, and invariably the time required for delivery is greater than when ordered direct. In this connection I quote below from our contract now in force with all the steamship companies plying between New York and Manila:

"7. It is further agreed that the party of the first part shall have preference over the general public in the transportation of its cargo, but that reasonable notice shall be given from time to time to the parties of the second part of the probable amount of such cargo, in order that the requisite stowage may be reserved."

Hence it will be seen that this bureau is better equipped to handle "rush" business and can do so for less cost than local firms.

Your attention is respectfully invited to Exhibit J, which shows that, notwithstanding the fact that in January, 1906, the commissary of the constabulary was turned over to this bureau, thereby entailing additional labor, care, and responsibility, we have decreased the operating expenses of the whole bureau very materially. It is respectfully suggested that if all special purchase privileges be recalled, and this bureau be required to make all purchases under the existing laws, a great saving would be effected. Bureaus which have the special purchase privilege file no estimates, but at pleasure make inroads on our stocks, forcing us frequently to buying in the open market for other bureaus that should be entitled to receive the goods estimated for at lowest prices. This applies particularly to the bureau of customs and the bureau of constabulary. Your attention is invited to act No. 146, section 5. The bureaus mentioned have not complied with this law for years. I fail to find any act of the Commission modifying this act (No. 146) in the matter of filing estimates.

RECOMMENDATIONS.

Your attention is further invited to the report of the reorganization committee in the matter of warehouses. That this recommendation be complied with is very essential. This bureau is now paying ₱45,000 per annum rent. If a suitable, up-to-date warehouse be constructed, the saving of this high rental and a very material reduction in the cost of administration would result, amounting to at least ₱65,000 per annum in the cost of administration of this bureau alone. To quote from the report of the reorganization committee in the matter of warehouse:

"It is believed that the annual net saving, if this recommendation is adopted, would be not less than ₱100,000."

This bureau stands ready to contribute ₱350,000 of its surplus toward putting this plan into effect at once.

Business conditions in Manila are far from satisfactory, owing to the unsettled conditions existing in some of the provinces, the failure of Congress to extend any relief in the matter of tariff, and the want of a definite settled policy toward these Islands. The business of this bureau has fallen off 28 per cent in the past year, and as we are the largest buyers and importers of general supplies this is a pretty fair index to the business conditions in Manila.

Respectfully submitted.

E. G. Shields,
Purchasing Agent.

The Secretary of Public Instruction,
Manila, P. I.

Note.—The following exhibits accompanying this report are on file in the War Department.

General statements.

Exhibit A.—General statement of bureau assets and liabilities.
Exhibit B.—Financial statement appropriation "Purchase of supplies."
Exhibit C.—Surplus account.
Exhibit D.—General statement of supplies account.
Exhibit E.—Statement of earnings and expenses, fiscal year 1906.
Exhibit F.—Sales of supplies, fiscal year 1906.
Exhibit G.—Comparative statement of sales.
Exhibit H.—Comparative statement of surcharge earnings.
Exhibit I.—Monthly operating expenses, fiscal year 1906.
Exhibit J.—Comparative statement of operating expenses. Auxiliary.
Exhibit K.—Stores account, commissary division.
Exhibit L.—Sales of stores, commissary division.
Exhibit M.—Loss sustained through commissary division.

Cashier's statements.

Exhibit N.—General statement of collections and deposits.
Exhibit O.—Condensed statement of sales, fiscal year 1906.
Exhibit P.—Abstract of departmental sales, fiscal year 1906.
Exhibit Q.—Abstract of provincial sales, fiscal year 1906.
Exhibit R.—Abstract of Congressional relief fund, auction and miscellaneous sales and collections, fiscal year 1906.
Exhibit S.—Departmental collections through auditor's settlement warrants.
Exhibit T.—Cash collections, fiscal year 1906.

Disbursing officer's statements.

Exhibit U.—Condensed statement of receipts showing distribution.
Exhibit V.—Detailed statement of receipts, fiscal year 1906.
Exhibit W.—Condensed statement of disbursements showing distribution.
Exhibit X.—Detailed statement of disbursements by months, fiscal year 1906.
Exhibit Y.—Abstract of cash payments covering purchases, fiscal year 1906.

EXHIBIT C.

REPORT OF THE DIRECTOR OF PRISONS.

DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF PRISONS,
Manila, June 30, 1906.

SIR: I have the honor to submit herewith my first annual report (fiscal year ending June 30, 1906) as the director of prisons, the bureau of prisons having been established, effective November 1, 1905, as per act No. 1407 of the Philippine Commission, embracing, in addition to Bilibid prison and Iwahig penal colony, 39 provincial prisons, all insular and provincial prisoners being placed under the general jurisdiction, supervision, and control of the bureau of prisons.

On the establishment of the bureau of prisons steps were taken to ascertain the condition of the 39 provincial prisons—the population, condition of prisoners, how officered and managed, the health of the prisoners, discipline, work employed at, length of sentence, crimes for which committed, number of adults and juveniles, males and females, etc.

This information was rather difficult to obtain, owing to the election of the provincial governors, the outgoing governors not caring to take up the matter, and after the election the new governors requiring some time in which to get settled in their new positions. After receiving sufficient data from a majority of the 39 provinces on which to base a fairly accurate estimate of the condition of the provincial prisons and prisoners, a trip of inspection was made, which included Pangasinan, Benguet, Union, Lepanto-Bontoc, Ilocos Sur, Ilocos Norte, Cagayan, Isabela, and later Laguna and Cavite. An inspection of these provincial prisons disclosed the fact that in all cases they could not be considered as secure, and that in the majority of cases they were decidedly insecure. There was a decided lack of discipline and control, and in many instances the attempt to carry out the sentence of the court was decidedly farcical.

Steps have been taken to establish uniformity throughout the islands in the matter of prison management, discipline, and security. A uniform system of records, with explicit instructions in circular form, are being prepared for the printer, viz: Instructions to wardens how to proceed from the time of the arrival of a prisoner until his discharge; directions for the management and discipline of the guard; suggestions regarding the establishment of industries, and a complete system of accounting for same. It is intended to arrange to place articles manufactured in the provincial prisons that will have a ready sale in Manila on sale at the sales room at Bilibid prison.

DISTRIBUTION OF PRISONERS.

Prisoners in charge of the bureau of prisons, aside from the provisions of act No. 1407, are distributed as follows:

Bilibid prison	3,554	
Hospital B	157	
		3,711
Iwahig penal colony		467
Camp Overton		152
Ligtong prison quarries		86
San Lazaro Hospital		59
Luneta police station		22
Fort William McKinley		15
Fort San Pedro, Iloilo		10
Hospicio de San José		9
Clarian prison, Zamboanga		8
Total		4,539

BILIBID PRISON.

The prison population at the morning count on July 1, 1905, was 3,131.

During the fiscal year there were committed for imprisonment and returned from the working parties, which had been transferred, 4,950 prisoners, while 4,370 were released from confinement and transferred, leaving a total of 3,711 in confinement in Bilibid prison and Hospital B, bureau of prisons, on June 30, 1906, an increase of over 18½ per cent.

The daily average of prisoners in confinement for the year was 3,700. The increase, as shown at the close of the fiscal year, is accounted for as follows:

Committed direct by the courts	3, 557	
Transferred to Bilibid	1, 393	
		4, 950
Released	2, 431	
Transferred away from Bilibid	1, 939	
		4, 370
Total increase in population for the year		580
The excess of committments over releases was		1, 126

Maintenance.—The gross cost of maintenance, which includes all expenditures for salaries and wages of officers and employees of Bilibid prison, except those in connection with the industrial division, consisting of subsistence, office and prisoners' supplies, illumination, burial expenses, donations, general repairs, and improvements, per capita for the year was ₱133.99+, or ₱0.367 per capita daily. Deducting the amounts that have been received and the amounts that are still due for maintenance and profits on the receipts from the proceeds of the industrial division, the net cost per capita annually is ₱72.63, or ₱0.199 per day, which is less than last year.

While the gross cost of maintenance is more than last year, it is accounted for by the fact that better facilities for the proper care of prisoners have been established, such as the new electric-lighting system, and much needed repairs which, together with the longevity increase in the salaries of the guards, the authorized increase in other items of salaries and wages, and the item of fuel, which was due to having to use old worn-out boilers until the arrival of the new boilers purchased from the United States.

It will be noted that the average number of prisoners last year was 4,033, as against 3,700 this year, and that it was not possible to make any reduction in the force of employees, number of lights, amount of fuel, etc., incident to maintaining the prison as a whole, on account of the reduction in the average number of prisoners to be cared for, about the only difference, of course, being in the cost of food and clothing.

By way of comparison, attention is invited to the gross cost of maintenance of prisoners in the United States. For instance, Rhode Island, ₱709.68; Minnesota, ₱355.58; Michigan, ₱318.74; Virginia, ₱153.26 per capita per year.

Discipline.—A steady improvement in discipline among the prisoners is noticeable. On July 1, 1905, 63.42 per cent of the prisoners were in the first class; 22.45 per cent were in the second class, and 14.12 per cent were in the third class, whereas on June 30, 1906, there were 65.29 per cent in the first class; 18.92 per cent in the second class, and 15.77 per cent in the third class. The increase of percentage in the third class was due to new prisoners coming in.

The steadiness of the prisoners on parades, in passing to and fro about the prison, in the pavilions after working hours, and in the shops, is very pronounced.

Attention is invited to the absolute necessity for perfect discipline, not only in order to properly handle so large a number of prisoners, but also in order to obtain results in the industrial division. The very gratifying results in the industrial division were in no small measure due to the discipline maintained therein. An idea of the state of perfection to which the discipline at Bilibid prison has attained may be better understood when it is known that the food issue at meal time to approximately 4,000 prisoners consumes only between seven and ten minutes.

Bathing, barbering, letter writing, visiting, and recreation are all taken care of outside of working hours, which consist of seven and one-half hours each working-day.

The percentage of punishments, as will be noted in the statistics appended hereto, is very noticeably less than in former years.

Health.—The report of the prison physician, who represents the bureau of health, has been submitted to the director of health, and will no doubt be embodied in the annual report of the bureau of health.

Industries.—During the year there has been employed in the various shops in this division an average of 848 prisoners per day. These prisoners are being taught the trades of the shops to which they are assigned. The results obtained have been very satisfactory, their work becoming of greater value as they become more proficient.

The sales of manufactured articles during the year amounted to ₱147,648.99, as against ₱51,601.39 for the fiscal year 1905, showing an increase for the year of ₱96,047.60, or 186 per cent.

In addition to this, work has been done for Bilibid Prison in construction and repairs in the laundry, tailor, and other shops, and in the stone quarry, amounting to ₱238,450.79. Charging this department with the entire cost of maintenance of all the prisoners working therein, the industrial division shows a net profit for the year of ₱50,078. Taking into consideration that the Government must maintain these prisoners, whether they engage in manufacture or not, the actual saving to the government in this division is ₱164,489.99, or a sufficient amount to cover the gross cost of maintaining 1,127 prisoners in Bilibid Prison.

Statistics appended hereto show the operation of each shop and the operation of the entire industrial division.[a]

Catalogue showing cuts and giving a description of the various articles manufactured has recently been issued and is increasing mail orders.

No other effort has been made to solicit business, but it is believed that it would be well to make an effort to secure a market for these products outside of the Philippine Islands, as the production can easily be increased several hundred per cent if a market can be found. Tourists from Australia and New Zealand have visited the sales room, and many of them have purchased the furniture manufactured in the industrial division to ship back to their homes, saying that none of the kind could be obtained there and that it would meet with a ready sale were it available.

The enlargement of the shops' space by the erection of the new shop buildings, which are just completed, includes for Department A the carriage, wagon, and blacksmith shops, iron-working machine shops, plumbing shops, etc., and for Department C the boiler house, dry kiln, and lumber shed. This allows for greater progress in these departments.

A vast improvement is noticeable in the output of the class of work done by the hard-wood furniture, the wicker-ware furniture, carabao horn curio, and silversmith, tailor, carpenter, and woodworking shops.

The installation of additional machinery in the laundry plant has enabled that section of the industrial division to do better work and handle the work more expeditiously than heretofore.

RELIGIOUS FUNCTIONS.

During the year the work of the regular chaplain included—

Religious confessions	244
Confessions made by the sick	402
Communion services	200
Burial services	299
Church services	60
Baptisms	10
Sermons, or instructions	40

The representatives of a number of other denominations held services at frequent intervals during the year at their own request, of which there was no record kept at this prison.

HOSPITAL B.

On July 1, 1905, the population of Hospital B was 61, and during the year there have been transferred to Hospital B from Bilibid Prison 257 prisoners, making a total of 318, of whom 134 have died and 27 have been returned to Bilibid Prison, leaving the number on hand at the present time 157 prisoners.

During the year the accommodations for patients at Hospital B were increased from 119 to 200.

IWAHIG PENAL COLONY.

The name of the Iwahig (Iuhuit) penal colony was changed by the committee on geographical names appointed by the Philippine Commission.

The number of prisoners at the settlement on July 1, 1905, was 239; transferred during the year, 332; recaptured, 24, making a total of 595, of whom 38 were returned to Bilibid Prison; 46 died at settlement; 3 were killed while attempting to escape; 9 were released at the settlement, and 32 escaped, leaving the number on hand 467.

All of those who escaped are believed to have perished, either at the hands of the Tagbanuas or of starvation.

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[a] Appendix is on file in the War Department.

The work accomplished during the year has consisted of getting out building material from the forests and swamps and building shelters for the additional prisoners as they arrive, shelter having been erected to accommodate over 600 prisoners. There are 450 acres of land cleared, 300 acres of which are under cultivation. There have been built 3 miles of fence of the amount required to inclose 350 acres, which will be put under cultivation as soon as it is completed, 2 miles of additional fence being necessary to entirely inclose the same.

The land under cultivation is growing 150 acres of upland rice, which it is expected will yield 6,000 bushels. Fifteen or twenty acres are planted to corn, the stalks of which stand 8 feet high.

During the year the following products have been raised:

Tomatoes (have just transplanted 6,000 more plants)	acres	12
Navy beans	bushels	30
String beans	do	50
Camotes	do	80
Corn on ear	do	50
Teosinte	ton	1
Tobacco	pounds	70
Rice	do	10,000
Roasting ears	bushels	200
Velvet beans	do	10

Also 465 young cocoanut trees, 241 of which have recently been transplanted; 1,150 banana trees of the lacatan, bungalan, latundan, and saba varieties. Five thousand young cocoanut trees raised from seed are about to be planted and two new bridges are about to be erected. Two miles of new road, three large boats for transporting scouts in case of necessity, two freight boats, and one passenger boat have been built.

A beginning has been made toward stocking the settlement with work and beef cattle, hogs, chickens, farming machinery, agricultural implements and tools, besides, of course, with the necessary supplies and clothing.

A police force, composed of the members of the settlement, has been established and uniformed. It is the intention to establish self-government to a certain degree; to lay out a plantation on a large scale; to provide homes for the families of the members of the settlement; to establish telephone communication from the settlement to Puerto Princesa, and to continue the transfer of prisoners to Iwahig at the rate of 25 per month, until the number has reached 1,000 or 2,000.

The health of the members of the settlement has improved very remarkably during the past year, and the sanitation of the settlement is now in a very satisfactory condition, all things considered.

CAMP OVERTON.

Four hundred and seventy-eight prisoners were at work on the Iligan-Lake-Lanao road on July 1, 1905. During the year, 281 of that number have been returned to Bilibid prison; 43 have died, and 2 have escaped, leaving a balance of 152 prisoners remaining at that station.

This office has already been notified that remaining prisoners will be returned in the near future.

LIGTONG PRISON QUARRIES.

On September 14, 1905, the rock quarries were established at Ligtong, near Meycauayan, Bulacan Province, for the purpose of quarrying stone for use at Bilibid prison. On October 6, 1905, 60 prisoners guarded by a company of scouts, were transferred from Bilibid prison to Ligtong, where a stockade and the necessary buildings were erected, and the quarrying of stone commenced. The number was afterwards increased to 153, of whom 1 died and 66 were returned to Bilibid prison, leaving a balance of 86 remaining at Ligtong.

SAN LAZARO HOSPITAL.

The insane prisoners sentenced to Bilibid prison are transferred by executive authority to San Lazaro Hospital. On July 1, 1905, 54 prisoners were present in the San Lazaro insane ward. During the year 19 were transferred to the San Lazaro insane ward, of whom 6 died, 3 were returned to Bilibid prison, and 5 were released from San Lazaro Hospital, leaving 59 insane prisoners remaining.

LUNETA POLICE STATION.

On July 1, 1905, 17 prisoners were present at the Luneta police station. During the year there have been transferred from Bilibid prison to the Luneta police station 53 prisoners, of whom 48 were returned, leaving 22 prisoners remaining.

FORT WILLIAM M'KINLEY.

Three hundred and seventy-three prisoners were at work on July 1, 1905, on the roads and plazas at the military reservation (20 of that number having been transferred from Malahi Island military prison to Fort William McKinley on October 7, 1905). The entire number were returned to Bilibid prison on July 3, 1905.

FORT SAN PEDRO.

On November 3, 1905, at the request of the military authorities, 15 prisoners were transferred to Fort San Pedro, Iloilo, of whom 3 died and 2 were returned, leaving 10 prisoners remaining.

HOSPICIO DE SAN JOSE.

On July 1, 1905, there were 7 prisoners confined in Hospicio de San Jose, and 2 juvenile offenders were transferred during the year, leaving 9 prisoners remaining.

CLARIAN PRISON, ZAMBOANGA.

The military authorities desiring prisoner shop foremen as instructors at prison shops at the Clarian prison, Zamboanga, 8 skilled prisoner workmen were transferred from Bilibid prison on October 14, 1905.

ALBAY.

Three hundred and twenty-five prisoners were working on the Tabaco-Ligao road on July 1, 1905. On July 8, 1905, 175 more prisoners were transferred, making a total of 500, of whom 26 died and 474 were returned to Bilibid prison.

STATISTICS.[a]

Attached hereto are tabulated statistics of all reports pertaining to prisoners in charge of this bureau, to which attention is invited.

Respectfully submitted.

George N. Wolfe,
Director of Prisons.

The Acting Secretary of Public Instruction,
Manila, P. I.

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[a] These statistics are on file in the War Department, also statement of improvements and repairs accompanying this report.

EXHIBIT D.

REPORT OF THE DIRECTOR OF PRINTING.

DEPARTMENT OF PUBLIC INSTRUCTION,
BUREAU OF PRINTING,
Manila, August 8, 1906.

SIR: I have the honor to submit the following report of operations of the bureau of printing for the fiscal year 1906:

For the first four months of the fiscal year the bureau operated under the credit-by-annual-report system, whereby the insular bureaus were not charged for printing.

Act No. 1407, known as the reorganization act, provided that "for all services rendered and for all supplies furnished * * * payment of the cost * * * shall be made by the department, bureau, office, or official to which or for whom such service is rendered or supplies furnished." It was also provided that the moneys so received should be deposited with the treasurer and considered as repayments to the appropriation for the bureau. Act No. 1416, however, provided a direct appropriation, and, inasmuch as it was the later enactment, the amounts collected for printing were deposited in the treasury as miscellaneous receipts.

In previous years printing was billed in accordance with an adopted scale of prices, which for the fiscal year 1905 proved to be considerably above the actual cost of operation. This scale was revised on all items which experience had shown to be above cost, with the object of providing a decrease of about 20 per cent. Inasmuch as the cut was not horizontal, and that it would require much clerical expense to compute the exact difference between the charges under the old and the new scales, the actual decrease on each job was not figured. The results for the year, however, prove that the effect was as intended. As compared with 1905, there was a decrease of 26 per cent in the total value of printing executed. Of this decrease it is believed that ₱32,672.90 was the resultant saving due to the provision of the reorganization committee requiring payment for all printing executed, as the amount expended for salaries and wages and for the supplies consumed in operation was that much less than the previous year.

There were completed during the year for the insular government 5,544 requisitions, with a total value of ₱381,027.68; for the provincial governments 5,212 requisitions, with a value of ₱104,506.23; for the city of Manila 560 requisitions, with a value of ₱22,636.55, and for the Federal Government and outside parties 775 requisitions, with a value of ₱13,914 (chief commissary, ₱2,091.80; United States Marine Corps, Cavite, ₱766.08; paymaster, U. S. S. *Rainbow*, ₱60). Credit refunds for eight months were valued at ₱51,022.25 for the insular government, ₱15,839.68 for the provincial governments, and ₱2,710.22 for the city of Manila.

Since it was required that from and after November, 1905, printing should be executed at cost, the honorable secretary of public instruction determined that the only elements entering into the charge should be the following: Salaries and wages, supplies expended, 10 per cent for wear and tear of equipment, and the actual expense of maintenance and repair of the building. As it is impracticable—in fact, impossible—to determine accurately the cost of an individual job, it was decided to give credits for the difference between the scale of prices and the cost of production after the cost had been determined for a given period. In this manner a credit refund of 24 per cent was given on the deliveries for November, December, and January; 17 per cent for February; 12 per cent for March and April; 28 per cent for May, and 30 per cent for June. Since the elements of cost were considerably narrowed by the above decision, the scale of prices again proved to be in need of revision, and for the present year bills will be made out from a new scale, which it is believed will more closely approximate the cost of operation.

It was provided in the reorganization act that after November 1, 1905, the printing, sale, and distribution of the Official Gazette, both English and Spanish editions, should be performed by the director of printing; also that all publications of the insular government, by way of sale, should be distributed by this bureau. All the clerical and bookkeeping work in connection with the subscriptions and mailing was included in this transfer. Tabular statements submitted as a part of this report prove that the transfer was an economy for the government. About the same time it was decided to publish the Journal of Science, also necessitating the receipt of subscriptions, and the accounting work connected therewith.

Progress has been maintained in the education of apprentices. Act No. 650, approved March 3, 1903, prescribed a three-year course of instruction in the printing trades. Under its provisions one employee has graduated in the composing room, one in the bindery, two in the electrotype and stereotype room, and one in the press room. Several more have nearly completed their terms, and graduation will follow periodically. There are 71 now receiving instruction. By reason of the advance in efficiency of the native force, especially of the apprentices, it has been possible to decrease the number of American craftsmen instructors by 7. This decrease amounted to one-fifth of the force of craftsmen instructors, so that the dependence of the bureau on the United States for its skilled labor has been very materially minimized, as shown by the following table:[a]

From the above it will be seen that craftsmen instructors must be qualified in all the specialties of their respective trades. Appointees to the composing room must be experienced on book, tabular, and job work, able to impose forms or make up, and competent to read proof, write jackets, or compute the product. Bindery appointees must be blank book and printed book forwarders, rulers, and finishers; those for the press room must be experienced on cylinder, platen, Harris, and embossing presses, and able to mix inks and make rollers; those for the foundry must be stereotypers, electrotype molders, and finishers; photo-engravers must be able to do line and screen work, to etch, route, block, and finish; and the electrician must also be an engineer and machinist. Men possessing these abilities are hard to secure, as they command high salaries in the United States. In considering appointments, much weight is also given to evidence showing administrative experience. Each employee now appointed is a potential foreman. For the above reasons it is not probable that the percentage of decrease will be as great the present fiscal year.

I submit tabular statements showing (1) the state of the appropriations; (2) production and cost of operation for the fiscal year 1906; (3) production and cost of operation for the eight months under act No. 1407; (4) value of equipment; (5) amount of salable documents; (6, 7, and 8) accounts of the Official Gazettes and Journal of Science; (9) printing and binding executed during the year; (10) credit refunds given during period November, 1905, to June 30, 1906. These tables[a] give a comprehensive account of the transactions occurring during the year.

Very respectfully,

JOHN S. LEECH,
Director of Printing.

HON. W. CAMERON FORBES,
Acting Secretary of Public Instruction,
Manila, P. I.

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[a] On file in the War Department.

EXHIBIT E.

REPORT OF THE DIRECTOR OF COLD STORAGE.

THE BUREAU OF COLD STORAGE,
Manila, P. I., July 28, 1906.

SIR: I have the honor to submit herewith the following report covering the operation of the bureau of cold storage for the period from July 1, 1905, to June 30, 1906.

On June 30, 1906, Mr. J. F. Edmiston, the director of cold storage, returned to the United States on leave, and this report has been compiled from existing records on file in the office, and consists of the following: [a]

Exhibit A—Articles of agreement with subsistence Department, United States Army, for cold-storage space.

Exhibit A2—Articles of agreement with Subsistence Department, United States Army, for cold-storage room No. 5.

Exhibit B—Articles of agreement with Subsistence Department, United States Army, for ice.

Exhibit C—Detailed statement of business transacted.

Exhibit D—Statement of expenditures.

Exhibit E—Collections and deposits.

Exhibit F—Statement of ice manufactured, sold and on hand.

The gross revenues for the twelve months were ₱713,047.92, and the expenditures were ₱271,791.82; the net earnings were therefore ₱441,256.10, which was a gain of ₱43,284.84 over the preceding year.

Very respectfully,

J. J. O'DONOVAN,
Acting Director of Cold Storage.

The ACTING SECRETARY OF PUBLIC INSTRUCTION,
Manila, P. I.

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[a] These exhibits are on file in the War Department.

BULLETINS

ON

SOIL CONDITIONS AND SOIL FERTILITY

IN THE

PHILIPPINE ISLANDS.

BUREAU OF AGRICULTURE.

(Bulletin No. 3.)

SOIL CONDITIONS IN THE PHILIPPINES.[a]

By CLARENCE W. DORSEY.

LETTER OF TRANSMITTAL.

BUREAU OF AGRICULTURE,
Manila, P. I., March 13, 1903.

SIR: I have the honor to transmit herewith, for publication as a bulletin of this bureau, a paper on the soil conditions in the Philippines. This contains the results of my examinations and studies of the soils in the various parts of the archipelago that I have visited since my arrival in Manila, May 21, 1902. Many exaggerated statements are made about the inexhaustible fertility and wonderful resources of the soils of the Philippines by persons doubtless misled by the luxurious tropical vegetation. While it is true that vast areas of fertile soils are found that will respond abundantly to modern cultural methods, there are also many localities where agricultural advancement can only be made by considerable expenditure of time and money. In spite of the fact that agriculture has been carried on for many centuries in the islands, the methods employed are crude and primitive in the extreme, and can not be expected to realize the true producing value of the soil.

That certain districts possess soils adapted to the cultivation of manila hemp, sugar-cane, rice, tobacco, cocoanuts, coffee, and cacao, has been proved beyond a doubt; but there are also many fine tracts of land where these industries can be greatly extended and improved and new crops, such as cotton and tea, a host of fine fruits, and minor produce crops can be profitably introduced. It is hoped that the descriptions of the soil and climatic conditions of the many localities visited may prove of benefit to those already engaged in agricultural pursuits, as well as those who may seek information concerning the natural resources and advantages of the islands, with the object of developing the latent energies of the soil.

Respectfully,

CLARENCE W. DORSEY, *Soil Physicist.*

Prof. F. LAMSON-SCRIBNER,
Chief of Bureau of Agriculture.

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[a] The following illustrations have been omitted from this report and are on file in the War Department:

Plate I. Laborer's house surrounded by abacá plants, Mount Iriga, Ambos Camarines, Luzon.

Plate II. Field of abacá protected by numerous shade trees, Sorsogon Province, Luzon.

Plate III. Unloading loosely bound bundles of abacá fiber from sailing vessels and spreading it to dry in front of large warehouses, Tacloban, Leyte.

Plate IV. Hauling dried abacá fiber to warehouses for assorting and bailing, Cebú.

Plate V. Cocoanut grove, Union Province.

Plate VI. Plowing for rice, Union Province.

Plate VII. Rice lands in interior valleys, Union Province.

Plate VIII. Igorot women digging camotes or sweet potatoes in eastern part of Union Province, Luzon.

Plate IX. Primitive method of grinding sugar cane, in common use in Batangas Province, Luzon.

Plate X. Small tobacco patch near native's house. Method of tobacco cultivation near San José, Luzon.

Fig. 1. Sketch map showing areas where soils have been examined.

Soil map, Batangas sheet, Luzon.

INTRODUCTION.

At the time the bureau of agriculture was organized, early in 1902, it was recommended by the chief of the bureau that soil investigations be carried on, similar to the work conducted by the Bureau of Soils of the United States Department of Agriculture. Arrangements were made for the temporary transfer of someone employed in the Bureau of Soils to inaugurate the work and to provide permanent plans for the further extension of soil work in the Philippines. The writer was selected for inaugurating the work, and arrived in Manila the latter part of May, 1902. Many localities were visited, and a glance at the accompanying sketch map will show where the soils have been examined in detail. Many months were spent in visiting the different parts of the archipelago, but much time was lost, owing to the slow methods of available transportation, especially on account of the long periods of quarantine in going from one point to another in the districts then infected with cholera.

SOIL CONDITIONS IN THE ABACÁ OR MANILA HEMP DISTRICTS.

At the present time abacá, or manila hemp,[a] ranks foremost among the exports of the Philippine Archipelago. While the excellent qualities of the fiber obtained from the abacá plant (a species of the banana family known as *Musa textilis*) have undoubtedly been known to the natives for hundreds of years, it is only during the last fifty or sixty years that considerable quantities of this material have been exported.

It is stated that in the year 1850, 7,309,296 kilos of abacá were exported. Twenty-five years later the shipment had increased to 32,414,315 kilos, while for the fiscal year 1901, 111,216,563 kilos[b] were exported, which brought $14,453,110.10, so that some idea can be gained of the wealth this industry brings to the archipelago. Abacá fiber is used principally for making ropes and heavy cables and for binder twine, although large quantities of the finer qualities are consumed by the natives for weaving into various kinds of cloth.

The area of the archipelago where the successful cultivation of abacá is carried on, roughly speaking, lies between the parallels 6° and 14° north latitude and the meridians 121° and 126° east of Greenwich. In southern Luzon the principal abacá-producing provinces are Ambos Camarines, Albay, including the island of Catanduanes, and Sorsogon. The islands Mindoro, Marinduque, Masbate, Samar, Biliran, Leyte, Cebu, Panay, Negros, Bohol, and Mindanao produce greater or less quantities of abacá fibers. In addition, the plant is grown on a large number of smaller islands which lie near some of those just mentioned. In many of the islands mentioned only small quantities of abacá are gathered, and frequently the little gathered is of inferior quality.

For the successful cultivation of abacá certain favorable soil conditions are essential, as well as suitable climatic conditions. The soil must be of lasting fertility and must be well drained, for abacá will not grow well on wet, poorly drained soils. The soils should be light and loamy, cool and moist. Gentle slopes, with what are known as "cool" lands, are to be preferred to swampy, low lying lands, often locally known as "hot" lands.

A moist climate is required, and it is often remarked in the abacá districts that the rainy season lasts the entire year, for the plant will not survive a period of six months of dry weather, and is seriously injured if more than six weeks elapse without some rainfall. A moist atmosphere, with heavy showers at short intervals, seems best adapted to the needs of the plant, with the present system of cultivation.

With the object of a preliminary study of the soils of some of the more important abacá regions, considerable time was spent by the writer in the provinces of Ambos Camarines, Albay, and Sorsogon in southern Luzon, as well as the more important regions of central western Samar and northeastern Leyte.

AMBOS CAMARINES.

In the province of Ambos Camarines there are several important abacá regions, the products of which are nearly all shipped from Daet and the capital, Nueva Caceres, situated near the center of the province on the Bicol River. The Mount Iriga district was the only one studied in any detail, but as the exports of abacá amount to from 3,125,000 to 3,437,500 kilos per year, it can be seen that it is an important one. Other important districts are situated in the eastern part of the province in the vicinity of

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[a] In this report the term abacá, used almost exclusively in the archipelago to designate the plant known to botanists as *Musa textilis*, will be substituted instead of the terms "hemp," "manila hemp," or "Manila."

[b] Monthly Summary of Commerce of the Philippine Islands, June, 1901.

Lagonoy and in the western part of the province, especially in the country adjoining Pamplona. The Mount Iriga district is situated in the southeastern part of the province, and all of the abacá shipped from the villages of Iriga, Buhi, and Baao may be said to come from this district. Mount Iriga, around the lower slopes of which the abacá "lates" or farms are situated, is an old volcano, forming a part of the chain of volcanoes which extends in a northwest and southeast direction. It lies about midway between the volcanoes Isarog and the Mayon or Albay volcano. Of less elevation than the other volcanoes, it rises above sea level approximately 1,212 meters. The form of the mountain is a symmetrical cone truncated at the top, with the slopes considerably gullied by stream erosion and washing. To the south and west are vast fertile plains formerly cultivated in rice; but at present, on account of the lack of suitable farm animals, these valleys are largely uncultivated.

It is on the north side of Mount Iriga that the cultivation of abacá is carried on most extensively, for on the south the slopes of the mountain possess stony, shallow soils that are unsuited to growing abacá. Apparently, during the last eruptions of the volcano, the winds blew from the south, and all the finer ashes and detritus from the volcano were collected on the north side, and it is from the weathering of these fine ashes and dust that the soils are derived. In places on the north side of the mountain there are areas where the soils are shallow and consist largely of masses of large bowlders mixed with sharp, coarse sand; but over the greater part of the northern slopes the soils are deep and exceedingly fertile. They consist of soft, mellow loams, in places slightly sandy, to a depth of at least 1 meter, and in many places the soils exceed this depth. There is little change in character or texture between soil and subsoil, and the soils are always deep, 38 centimeters being about the average depth. These soils are rich in decayed organic matter and, even where abacá has been grown for forty years, there is apparently no diminution of the original fertility. Protected from the washing of the heavy rains by the thick growth of abacá and by the always rotting mass of dead leaves and trunks of the plants from which the fiber has been extracted, these soils are kept in a state of almost virgin fertility, for all vegetation is returned to the soil on which it grew, except the extracted fiber.

These soils possess excellent drainage, and the hardest rains readily percolate through them on account of the loose, mellow nature of the soil. The color of these soils varies from a purplish red, the color of the rocks and sands from which they are derived, to a yellowish brown and jet black. On the lower slopes the purplish red color predominates, while on the upper slopes the soils more commonly have a brownish or black color. These soils are thoroughly decomposed and contain no trace of the sharp, volcanic dust and ashes from which they are undoubtedly derived. There are some slight variations where the rains have collected into streams and formed slight gullies down the mountain sides. Along such gulches there is found a greater abundance of coarse sand and frequently large masses of bowlders and stones brought down from the higher slopes.

Where there is an abundance of stones, or where the soils contain much coarse sand, such good results are not obtained as where the soils are deeper and consequently richer in plant food.

Abacá has been grown in this district for more than forty years, and the present prices have stimulated the development of the industry, and new lands, higher on the mountain, are being cleared, preparatory to planting the crop.

The abacá produced in this district is shipped in large, loose bales on barrotos, the local name for the long, narrow boats used on the Bicol River. Two of these long barrotos are lashed together by means of bamboo poles and bejuco and will carry a considerable load of loosely bound abacá to Nueva Caceres. Here it is assorted into the various grades by skilled workmen in one of the large warehouses and rebaled in bundles of 125 kilos each. From this city it is shipped by light-draft steamships to Manila and from there to all points of the world.

ALBAY.

At present Albay is the greatest abacá-producing province in the archipelago. While the market price does not equal that of the product of Sorsogon or Leyte, still the prices at the present time are so much in advance of several years ago that the cultivation of abacá is practically the only industry in the province, and former crops and occupations are abandoned for the more profitable abacá. The province is fortunate in possessing two good ports, Legaspi and Tabaco, and from these large shipments are of almost daily occurrence. During the year 1900, according to the Monthly Summary of Commerce and Finance, the province of Albay shipped 30,382,812 kilos of abacá, more than one-fourth of the amount shipped from the entire archipelago. Large quantities of abacá are gathered in the region adjoining Tabaco, while the towns of Polangui, Oas, Ligao, Guinobatan, and Camalig, in the central part of the province, all furnish considerable quantities for shipment. The very finest quality of abacá fiber is said to be grown in the rough and rather inaccessible southwestern part of the province. This is generally shipped from Donsol, in Sorsogon Province, although it occasionally finds its way to the Legaspi markets.

No mention of the soils of this province should be made without some reference to the majestic Mayon volcano, from whose ashes and dust nearly all of the soils of the province are derived. Situated near the seashore, it towers 2,415 meters above the surrounding country and is a noted landmark in navigating the waters of this part of the archipelago. The cone is considered by many the most symmetrical of any volcano in the world. Numerous instances of damage wrought by its eruptions are recorded by Spanish and other observers, and, even during the American occupation, one slight eruption has taken place, although no serious damage was done.

Inasmuch as the soils of this province are derived from similar materials, it is to be expected that they should all be quite similar. Moreover, the soils of this province are also somewhat similar to the soils of the Mount Iriga district, since all have been derived from volcanic rocks, ashes, and dust of similar composition. Volcanic soils are nearly always exceedingly fertile, and the soils of this province are no exception. Seldom are heavy clay soils found in the province, but all variations from light sandy loams to heavy sandy loams and silty loams can be found. Around the foot of the Mayon volcano abacá is cultivated extensively, especially on the northern slopes. The farms do not extend far up the mountain sides, although they reach greater elevations in the vicinity of Tabaco. Usually, the lands around the base of the volcano are not as much sought after as are the small hills and rolling lands farther west in the vicinity of Ligao, Guinobatan, and Camalig. Near the volcano the soils are black, sandy loams, mixed with fine black gravel, and a small proportion of silt and clay. Usually, at a depth of from 25 to 40 centimeters below the surface, a layer of many centimeters of distinctive volcanic gravel and coarse sand is found and, under this, heavier loams and fine sand occur.

In the soils here, as in all the soils of the province, the fine sand is sharp and feels like bits of broken glass mixed with the fine earth. These soils are fertile and support only a fair growth of abacá plants, but the quality is good. In some places around the foot of the volcano the streams are building up great sloping plains of black, loose, coarse sand, so open and porous that only coarse grass, similar to the cogon (*Imperata arundinacea*), can find a footing. These sands would be productive, provided they did not shift and vary their position with each heavy rainfall.

In other places near the foot of the volcano, where larger streams occur, are great bowlder trains, in places many hundreds of meters in width and containing bowlders of dark volcanic rock weighing upward of several metric tons. In one place a cocoanut grove was observed that was being slowly buried by the great mass of bowlders and stones being heaped upon it with each succeeding flood.

From Ligao toward Polangui there are large areas of rice land, but the latter town is the center of a large hemp industry. The quality of fiber, however, does not compare favorably with that of the rest of the provinces, but corresponds more closely to that shipped from Daet, the former capital of Camarines Norte.

Between Ligao and Guinobatan the hills and rolling lands are exclusively cultivated in abacá, and many fine "lates" are seen. The soils in this section of the province are dark brown and yellowish brown loams that are composed of fine silt mixed with very fine sand and some sharp gravel and very coarse sand. These soils are rich and fertile, as the large fields of abacá testify. They are easily drained, and even the heaviest rains readily percolate through them. They have been cultivated in abacá for many years and some of the best fiber of the province comes from this section.

On the hills west of the town of Guinobatan a fine quality of abacá is produced and as noticed in so many other localities, the higher the location the better the quality of the hemp. On the top of one of these hills, perhaps 100 or 125 meters above the town of Guinobatan, a sample of soil was collected which consisted of a rich dark brown loam to a depth of 25 centimeters, while the subsoil was composed of a dark yellow loam with some sharp angular volcanic glass sand to a depth of 65 centimeters, and at this depth small gravel was encountered. In a region where heavy showers occur at frequent intervals such a soil will maintain just the proper heat and moisture conditions not only for abacá but for many other valuable crops as well. The underlying gravel beds will insure a perfect underground drainage, while the loamy nature of the surface soil will catch and retain the abundant rainfall. The rapid decomposition, under tropical conditions of a moist and warm atmosphere, of the small particles of sand and gravel constantly sets free an abundant supply of fresh plant food, so that the fertility of these soils is easily accounted for. In this section of the province many other crops were formerly cultivated, among which may be mentioned flax and wheat, potatoes, sweet potatoes, and corn, but the cultivation of practically all of these crops has been given up.

Between Guinobatan and Camalig a broad sloping plain of black shifting sand is encountered that has at present little or no agricultural value. The hills to the west of Camalig are used largely for abacá, but formerly some cotton and a fine variety of coffee are said to have been grown. The soils in the neighborhood of Camalig bear striking resemblance to the soils of the other districts mentioned in the province. On the sides and lower slopes of the hills are heavy brown loams, mixed with some sharp sand, while the subsoils are yellowish silty and sandy loams. On the crests of the hills and ridges sandy soils were noticed that frequently contain alternating layers of dark sand and fine gravel, interbedded with silt and fine sand. Much abacá of a good quality is grown about Camalig, and the region extends many miles to the west of the town. Good abacá properly cared for in this locality will average 2.7 meters in length. It is said that in the year 1892, from Camalig, 312,500 kilos of abacá were shipped each month during the height of the gathering season. Since that time no accurate statistics have been collected from this particular neighborhood.

SORSOGON.

This province contains many districts exclusively cultivated in abacá, and the sale of this commodity constitutes its greatest source of wealth. In addition to the large areas under cultivation, there are also large tracts which at present are rapidly growing up in dense jungle, on account of the scarcity of labor to prepare the fiber for market. The harbor facilities of the province are not of the best, although there are several ports where steamships touch to receive cargoes of dried abacá.

The price realized for the abacá of this province was, according to the market report of September 1, 1902, published in the Manila Daily Bulletin, 27 pesos per picul, as against 26½ pesos for Leyte and 24½ pesos for that of Albay. The largest shipments are made from Sorsogon, the capital of the province, near which the finest abacá of the entire province is produced.

The largest and finest "lates," or farms, are situated near Irocin, in the southern part of the province, quite near the active volcano Bulusan, but the abacá produced here is more fleshy and, while the plant makes a large growth, the quality does not compare with that produced in other districts near Sorsogon.

The finest quality is said to be grown near the barrio Pangpang or San Ramon, about 6½ kilometers west of the city of Sorsogon. Abacá is grown on the foothills and lower slopes of what are known as the Castilian Mountains, evidently the dissected and eroded remains of a former volcanic group of mountains. The soils for the greater part consist of rich-looking sandy loams of a dark brown color, light and loose and always moist and cool, with the abundant rainfall and the protecting shade of many trees with wide spreading-branches. The protection of the ever-present mulch of decaying abacá stalks and leaves, as well as the leaves of the shade trees, also helps conserve the moisture in the soil, for in this locality the soils are shallow, seldom exceeding a depth of 60 centimeters. The subsoils are usually heavier in texture, although they nowhere in this vicinity can be called clay loams or clays, for a certain amount of coarse sand is always mixed with the soils, as well as subsoils. The sands of the soils in this province have none of the sharp, glass-like edges of the sand found in Albay Province, but they are rather more rounded and worn by atmospheric decay, as well as the wearing action of running water.

Great bowlders, often 1 or 2 meters in diameter, are found scattered about on the surface, or deeply buried in the soil. These consist of dark-colored vesicular volcanic rocks, and it is from these rocks that the soil is being formed by the slow processes of weathering and atmospheric decay. Cultivated in crops that would leave the surface bare the greater part of the year, these shallow soils would soon be washed to lower levels, leaving only bare rock in their place; but, with the thick growth of abacá, the soil is amply protected from the washing effects of heavy tropical rains. Fields of abacá were seen in this vicinity that are known to have been in cultivation for more than seventy years, and, while the yield per hectare has undoubtedly greatly decreased, the quality of fiber has correspondingly increased, and this region produces white abacá of a fine quality.

From Sorsogon northward toward Bacón considerable abacá is grown, and of fine quality. Here the plant is grown on a slight plateau, nowhere perhaps exceeding 30 meters in elevation. From Sorsogon the country slopes gradually northward, but near Bacón the change in elevation from the sea level to the upland is more abrupt. In this vicinity the soils approach in character those that have been described as occurring in the Mount Iriga district of Ambos Camarines. The soils are rich mellow loams of dark color, with subsoils consisting of loams of similar texture and composition, but of a decided yellowish color. In some places the soils become more sandy and grade into still more sandy subsoils. In places, considerable numbers of bowlders are scattered about on the surface. Where the soils consist of the mellow loams large and well kept fields of abacá were noticed, and, on account of the nearness to the cities of Sorsogon and Bacón, little difficulty is experienced in getting sufficient labor to prepare the fiber for market. When so prepared, it is hauled in carabao carts or packed on the backs of carabaos to Sorsogon, where the work of resorting, grading, and baling is carried on.

Southeast of Sorsogon, just north of the mountains that form part of the series which surround Bulusan volcano, is a broken and eroded tableland, where many large and extensive abacá fields are seen. The quality of the fiber does not compare favorably with that of many other sections of the province, and many large fields can be seen that are uncultivated on account of the lack of suitable help. This broken and eroded plateau is more than 100 meters above sea level and descends abruptly on the Pacific coast side. The soils of this plateau are uniform in character, and are heavier in texture than any observed elsewhere for the cultivation of abacá. In many places the soils were in poor condition—that is, they contained excessive amounts of acid and smelled badly—and showed plainly the ill effects of imperfect aeration and lack of proper cultivation. The soils of this section of the province consist of closely compacted heavy loams to a depth of 15 to 22 centimeters. The subsoils are heavy clay loams of yellowish color. From the heavy character of both the soil and subsoil, good underdrainage could not be expected, and frequent stirring of the surface soil should be resorted to to prevent the top soil from becoming compacted and rendered impervious to water. With deep plowing and the application of green manures, these soils could be made very productive; but in their present condition, they are not well adapted to producing the best results with abacá. These soils have apparently been derived from volcanic rocks, presumably from former lava flows. The soils are 2 or 3 meters in depth and only in places can the parent rock, from which the soils are derived, be detected. In many places in this region large bodies of land are frequently connected with each other by very narrow necks of land, and, from the general level of the remnants of the once continuous plateau, one descends to flat, swampy bottoms by steep, precipitous slopes of 20 to 50 meters. On these bottoms attempts have been made to cultivate rice in some places. In other localities the blue clay soils of these bottoms are too wet and swampy to admit, in their present condition, of any cultivation whatever.

When the conditions of soil and climate are considered, it is seen that they are very favorable for the cultivation of abacá in Sorsogon Province. The natural conditions are so favorable, with some minor exceptions, that, with the proper adjustment of transportation facilities and labor conditions, the cultivation of abacá should become a far greater source of revenue than at present.

SAMAR.

In this province only very limited opportunity was given to observe the abacá soils. The capital, Catbalogan, as well as the city of Calboyog, are probably the most important shipping points for the abacá produced on the island. But little abacá is produced near these cities, the supply coming from the hills in the interior. There are practically no roads on the island, so the abacá is carried down the rough trails to the large rivers, and from there shipped to some of the larger towns for reshipment to ports where large vessels touch. The finest quality of abacá is said to be produced in the northern part of the island, but a good quality of fiber is produced in the hills along the Gandara River. There are many good abacá-producing districts, but the transportation question is often a serious one, on account of lack of roads. The country is sparsely populated, and its unsettled condition for the past few years has seriously operated against the attention being given to the cultivation of abacá that it deserves, so that many plantations have been allowed to grow up in jungle. Very recently, however, more abacá is being prepared and is coming to the markets in considerable quantities.

On the west side of the island there is considerable uniformity in the soils. In the hills about Catbalogan, for several kilometers eastward from the coast, the soils consist of heavy yellow clay loams that are underlaid by a yellow clay loam of heavier texture. At a depth of something over 60 centimeters the clayey subsoils grade into a loose, sandy mass of decomposing rock. These soils easily become compacted, rendering them impervious to the ready passage of rain water. In the narrow trails this clay becomes, during the periods of greatest rainfall, wet and slippery, making travel over them dangerous and at times well-nigh impossible. These soils in large areas are at present only used for growing small patches of corn, upland rice, and sweet potatoes. They are apparently derived from calcareous sandstones, although granite of fine quality and texture is found in the central part of the island, and has been reported as giving rise to similar clayey soils. Along the western coast, in the neighborhood of

Catbalogan, limestones crop out and the soils are heavy clay loams and clays. On the east coast of the island the soils, instead of being heavy clay loams, are reported to be more loamy in character, and correspondingly more rich and fertile. Consequently, on the east coast of the island cultivation of the land is carried on to a greater extent, and extensive rice fields are found, as well as some sugar cane. Much of the island consists of unbroken forest, and many years must elapse before any great advancement can be made along the lines of successful agriculture.

LEYTE.

From Leyte a fine quality of abacá is shipped, and for many years the island has enjoyed the reputation of being one of the foremost abacá producing districts of the entire archipelago. The finest quality of abacá is probably that produced in the extreme southern part of the island, in the hilly region adjoining Malitbog Bay. The northeastern part of the island has for a long time also been known as a fine abacá region. In this section of the island the greater part of the abacá grown is found on long, gently sloping lowlands, rising gradually back to the mountains in the interior of the island. In none of the abacá-producing regions mentioned so far has the cultivation of abacá been successful on such land, but the level or sloping lands are the rule in northeastern Leyte. These lands are not marshy, but are said to be cool, and to possess the abundant rainfall and moisture which the plant thrives best upon, with the limited cultivation it receives. The soils of this section of the island, while not clayey, are heavy silt loams and, from their texture and composition, would make excellent sugar lands, except for the prevalence of great swarms of locusts at times. These silty loams are alluvial in origin and are rich, fertile, and of considerable depth. Farther inland there is a gradual transition to more sandy soils, until the heavy silty soils are entirely replaced by heavy sandy loams better adapted to producing a finer quality of fiber, but with a greatly diminished yield. The sandy loam soil possesses heavy sandy loam subsoils, and in places there is a slight admixture of gravel. The character of the sand and gravel is that of water-worn and water-deposited material, and unlike the sharp sands and gravels of Albay Province. The sands and gravels are undoubtedly derived from rocks of volcanic origin, for it is a well-known fact that there are several old volcanic cones in the center of the island. From the abacá regions in the northeastern part the extracted fiber is packed on carabaos to the nearest coast towns and shipped from there in small sailing vessels to Tacloban or Carígara. At these ports it is assorted, repacked, and baled or shipped direct to Manila by large steamships. The mountainous island Biliran also belongs to this province, and abacá is produced in considerable quantities on the entire island.

OTHER LOCALITIES.

In addition to the provinces just mentioned there are many other islands or parts of islands where considerable abacá is cultivated, and where large sums of money are realized from the sale of the extracted fiber. Up to the present there has been no opportunity to study the soils of these localities, so little more than the mere mention can be made of these districts.

Marinduque, one of the smaller islands just west of Tayabas Province, has long been noted for the fine quality of extra white abacá produced. The fiber is short, but of a quality well adapted for weaving purposes. The surface of the island is rough and mountainous, and the large mountain in the extreme southwestern part of the island is undoubtedly an extinct volcano.

Mindoro, the large island just south of Batangas Province, annually exports a small quantity of abacá fiber. The island is sparsely settled, but the cultivation of abacá is said to be increasing each year. The surface of this island is quite rough and broken, and there are many high mountains, the most noted of which is Mount Halcon.

Masbate produces limited quantities of a fair quality of abacá. The island is rough and mountainous, and the cultivation of this valuable fiber could be considerably increased.

Panay.—Only small quantities of abacá are exported from Panay, and this is not of a good class, as the fiber is inferior in quality and of short length. The largest shipments of abacá from the island are probably those from the province of Capiz.

Negros.—In this island the cultivation of sugar cane takes first rank, but considerable abacá is also produced. The southwestern part of the island is said to be the part producing the greatest quantities. In middle Occidental Negros some abacá is raised. The hills are all far inland, near the lower slopes and foothills of the central chain of mountains, at an approximate elevation of 300 meters above sea level. In some localities abacá is found growing on reddish gravelly soils. These soils consist of heavy loams, and contain much sandy broken rock rather than river gravel. These locations are on the summits of outlying foothills. The fiber of the abacá grown in these soils, while of short length, brings a good price on account of its extra quality. Again, in the same part of the island, abacá is grown to some extent in virgin forest in dense shade on the lower slopes of the mountains. In these locations the yellow clay soils were overlaid by 5 or 8 centimeters of black, decomposed vegetable mold. The shipment of abacá from the entire island is small, as compared with such provinces as Albay, Sorsogon, Samar, and others.

Cebu.—A large amount of abacá fiber is exported from the city of Cebu that is produced elsewhere; as, for example, much of the abacá grown in western Leyte. The total shipments made from this point during the year 1900 were less than one-tenth of that from the province of Albay. The cultivation could be greatly increased and shipments made direct from Cebu to foreign ports of the rebaled and assorted fiber, thereby saving the cost of reshipping in Manila.

Mindanao.—From this large and important island large quantities of abacá are annually exported and, by comparing the number of kilos exported during the year 1900, as given in the Monthly Summary of Commerce and Finance, it is seen that the figures about equal those of Ambos Camarines and Samar provinces. In the northern part of the island abacá is largely cultivated, as well as in the southwestern part. In the southwestern part the abacá is grown on soils of alluvial origin; that is, they are the result of the overflows and deposition of the sediment carried by the streams. They are rich, heavy loams, composed largely of silt, with a high percentage of decomposed organic matter. The lands occupied by these soils are nearly level, sloping very gently to the seaward. Abacá is cultivated to the water's edge along the coast. In soils of such natural richness and fertility as these, the natural tendency would be to a rank and rapid growth of fleshy plants, although the quality of fiber would not be of a high grade.

Basilan and Jolo.—In these two small islands abacá is also cultivated to some extent. The sites chosen for abacá are low places of much the same character as in southwestern Mindanao. It is rarely grown in the hills, but in low areas that have rich, silty soils of alluvial origin.

CLIMATIC CONDITIONS.

While the number of stations recording the rainfall and temperature conditions of the principal abacá districts is small, still there are some features brought out by these records that deserve mention. The climate, for the greater part of the regions of the archipelago at present known as abacá-producing districts, is not characterized by a pronounced wet and dry season as is western Luzon, Panay and Negros. In these districts the distinction is decidedly marked. There, according to tables given on page 225 of Volume IV of the Philippine Commission Report, from three to ten times as much rain falls during the wet as during the dry season. On the other hand, in the regions producing the greater part of the abacá exported, the rainfall of one period of the year nearly equals that of the other six months of the year. In Albay, one of the greatest abacá districts in the Philippines, one frequently hears the remark that the rainy season lasts the entire year. The rainfall exceeds 2,960 millimeters (118 inches) and, while some portions of the year receive more rainfall than others, yet rarely does a week pass without a heavy shower. Little provision is made by the natives to store the water and, when a period of two weeks elapses without rainfall, the people are subjected to great inconvenience for their water supply. While the rainfall of this province is greater than that of any other of the abacá localities, still the rainfall is distributed in much the same manner during the entire year.

It is this regular distribution of the annual rainfall that controls in a great measure the development of the abacá industry in the Philippines and, with the present system of cultivation, it is to be doubted if the industry could be introduced in other sections of the archipelago where the wet and dry seasons are pronounced, unless a radical change is made in cultivating the plants. A period of six weeks' drought will affect the character of the abacá plant considerably, but will not inflict serious damage; but longer periods of extremely dry weather injure the fiber as well as the rapidly growing young plants. Frequent rains, sufficient to keep the soil cool and moist, and heavy dews, which often are as effective as light showers, are the requisites of the climatic conditions best suited to the successful development of the plant. Rich, heavy sandy loams are to be preferred over other soils, for these allow the ready percolation of the rain waters through them and the free circulation of the air so necessary to keep soils in good condition. Soils covered with large bowlders are to be avoided as much as heavy, close impervious clay soils. Sloping lands that are so situated as to be, on account of their location, free from destructive winds, are much to be preferred, rather than flat lands.

As to the question of cultivating the soil to conserve the moisture and the planting of leguminous crops to increase the supply of nitrogen in the soil, besides adding large stores of organic matter, these are questions that at the present are altogether untried. Much can be done by proper cultivation of the soil, selection of those varieties of plants that are known to yield a fiber of a superior color and strength, pruning of unnecessary suckers, so as to allow only the best plants to come to maturity, more careful judgment of the best soil to mature no more plants than can be done with the best results as to quality and length of fiber, etc. These are some of the matters that need careful attention in the future development of the industry. The question of fertilizers is an altogether unknown field. No attention has been paid to them; hence it is not known whether the soil is so exhausted that the application of limited amounts of fertilizers would sufficiently increase the yield to justify their application. In many areas the fields have been cultivated for scores of years, and certainly the original supply of plant food is greatly diminished, but the question of the cost of fertilizers and the increase in yield can only be determined by experimentation along careful lines. The question of shade and protection trees needs consideration. It should first be demonstrated that they are essential; next, the number and character of trees best suited to the plant should be determined and an effort made to introduce only such trees as are beneficial, instead of choosing at random certain trees to be left standing when new lands are cleared.

Given the proper cultivation and selection of areas suitable for the growth of the plant, it yet remains to be seen whether or not the industry can be profitably introduced in other parts of the archipelago. While suitable soils can be found, the climatic conditions are adverse in large areas of the island; but, with the abundant and cheap water supply for irrigation that exists in so many districts, and cultivation that will help maintain suitable moisture conditions, not only during the dry but the wet seasons as well, the industry might be introduced in many districts and become as great a source of wealth to the people as in the provinces, where it is already cultivated.

SOIL CONDITIONS OF UNION PROVINCE, LUZON.

Union Province is the southernmost of the long, narrow provinces on the western coast of northern Luzon. On the north is the province of Ilocos Sur; to the east Lepanto and Benguet; to the south Pangasinan; while on the west it is bounded by the Lingayen Gulf and China Sea. Union lies between 16° 8′ and 16° 56′ north latitude, and 120° 15′ and 120° 50′ longitude east of Greenwich, according to data published in 1891 by the Spanish Institute of Geography and Statistics. The same authority gives the area as 2,008 square kilometers. The province is traversed from north to south by high ridges of mountains, broken at intervals by large rivers. The capital, San Fernando, possesses one of the best harbors on the western coast of northern Luzon. Along the coast the principal towns are situated, connected with each other by carriage roads.

The principal crops produced are rice, tobacco, cocoanuts, sugar cane, cacao, sweet potatoes, and peanuts. Only tobacco is grown in sufficient quantities for export. In the rougher, more mountainous portions of the province, much upland rice is grown, and large quantities of sweet potatoes. The rainfall and temperature conditions are similar to those of the other provinces in this portion of Luzon, namely, a distinct dry season of little or no rainfall, and a pronounced season of heavy rainfall. During the months of December, January, February, and March, only a few millimeters of rainfall are recorded, while during June, July, August, and September the total rainfall exceeds 2,000 millimeters.

The Ilocanos comprise the population of the country along the coast; but farther east in the higher mountains are found scattered rancherias or settlements of Igorots.

PHYSIOGRAPHY.

The surface configuration of the province may for convenience be divided into four types, namely: (1) The coastal plain region bordering the China Sea; (2) the coast range of hills; (3) the broad interior valleys; and (4) the mountain ridges and chains with their narrow valleys in the eastern part of the province.

The coastal plain region.—Extending the entire length of the province is a well-defined plain fringing the China Sea from a few meters to more than 7 kilometers in width. On the landward side this plain terminates abruptly at the foot of the steep hills just referred to as coast ranges of hills. Often these plains are quite level and only elevated a few feet above the water's edge; again, they may slope gradually from the base of the hills to the sea, or may be broken by large areas of swamps which have no connection with the tides. From the character of the materials comprising these deposits, they are undoubtedly of sedimentary origin, and apparently prove that this portion of Luzon is rising at the present time.

The coast ranges of hills.—These stand out in bold contrast to the level plain bordering the sea; but, seen from the sea, they attract little notice on account of the extensive ranges of mountains farther to the eastward.

The division of coast hills and mountains is somewhat arbitrary, for no sharp line can be drawn between them. Coast hills, as referred to in this report, are the elongated narrow ridges traversing the province in a northerly and southerly direction, and seldom exceed 300 meters in elevation. On the seaward side they are steep and precipitous; to the east they follow each other in rapid succession with intervening narrow valleys. These hills have been carved out of a sloping plain, composed of volcanic tuffs, sediments, and coarse conglomerates. They belong to a much older period than the comparatively recent coastal plain. Near the sea these hills have an elevation of little more than 30 meters, but each ridge farther inland stands out in bolder relief, until the long winding ridges insensibly merge into the higher chains of mountains.

Interior valleys.—At varying distances inland from the seacoast, broad valleys open out, forming a pleasing contrast to the long, narrow ridges of the coast hills. Such valleys are found east of San Juan, a short distance east of San Fernando, and about Naguilian and other places, where the main rivers which arise in the higher mountains are joined by lateral tributaries which receive the drainage from the coast hills. These valleys are quite level, with sometimes well-defined terraces and slightly marked changes in elevation. They are situated but a few meters above the level of the river; consequently, during periods of great rainfall, they are subject to overflow which at times greatly damage the growing crops. These valleys contain some of the richest farming land of the province. They have been constructed by the gradual accumulations of sand and silt deposited in times of high water. None of these valleys contain more than a few square kilometers, and seldom lie more than 20 meters above sea level.

Mountain ranges.—The eastern part of the province is rough and mountainous, and only a few winding, rough trails traverse this country. The valleys are few and narrow, and the small, turbulent rivers run through channels filled with bowlders of all sizes. While farther east the mountains broaden out, forming elevated plateaus, in this province the mountains consist of scattered peaks and connected ranges of mountains whose summits attain elevations as great as 1,500 meters. These ridges are steep and precipitous and generally thickly forested, except where the Igorots have made small clearings for rice fields and sweet potatoes.

SOILS.

An examination of the soils of the province shows marked differences in their agricultural value, their adaptation to various crops, in their composition and texture as well as in the manner of their formation. As the surface features have been referred to as coastal plain regions, etc., the soils of these various physiographic divisions may be described in the same order.

Coastal plain soils.—The soils along the seacoast consist of sand and silt in varying proportions. At the very water's edge are usually found sandy soils, loose and incoherent, composed mainly of loose sand mixed with greater or less quantities of organic matter. In some places, as just south of San Fernando, the driving action of the monsoons has blown this sand into heaps or dunes, and these shifting dunes have traveled inland fully one-third of a kilometer. Such dunes or drifting ridges of sand support only a scant covering of scattered tufts of grass. Where the action of the winds is less potent, and where the sands contain more of the elements of plant food, cocoanut trees succeed quite well, and the remark is often heard in many parts of the province that the nearer the seashore the sweeter and richer the cocoanut.

Back of this line of sand dunes are frequently found low, marshy areas, filled with standing water the greater part of the year. Occasionally these low swamps extend nearly to the foot of the first range of coast hills. Many of these low, swampy lands would make excellent soils if properly drained and cultivated. Where the position is not too low and the soil consists of silt or sandy loams instead of the heavier clay loams, these tracts would produce fine groves of cocoanut trees. On the higher level or gently sloping lands of this region, soils are found of sand, silt, and clay in varying proportions. Generally speaking, the soils of this part of the province are heavy, silty loams, to a depth of a few meters. They are of dark color and are rich in organic matter. They are undoubtedly of alluvial origin and represent the finer sediments of slowly flowing currents of water. In many places the method of plowing while the land is covered with water has puddled the soils so badly that water percolates through them very slowly. These lands are cultivated to some extent to sugar cane, and the low-grade sugar made in this section finds a ready sale at a fair price in the local markets. Little attention is paid to the cultivation of the crop, and still less care is bestowed on the selection of the most successful varieties of seed cane. Rice and tobacco are alternately grown on large tracts of these heavy loams. Rice is planted just at the beginning of the rainy season, and tobacco immediately after the rice harvest. While these lands, on account of their texture and location, are excellent rice lands, the same can not be said about tobacco, for their proximity to the sea makes them of little value as tobacco lands. Tobacco grown here has poor combustibility, and is of poor quality, although much of it is annually exported from the province, as well as supplying a large local demand.

The higher, better-drained portions of the coastal region possess excellent soils for cocoanut cultivation and, in addition to large plantings in cane, rice, and tobacco, many groves of thousands of trees are scattered along the coast. The cocoanut industry is a profitable one to the province, although no exports are made of either oil or dried copra. In the further extension of the industry, special attention should be given to the proper cultivation of the land, both before and after planting the trees, as well as the application of proper fertilizers known to give the best results on cocoanut land. The selection of those nuts from trees known to yield large numbers of fine cocoanuts should also be given much care.

These lands along the coast are thickly settled, and by far the greater part of the population of the province live in the pueblos or barrios situated at short intervals near the seashore. A carriage road traverses the entire distance of the coastal plain country; but, in the rainy season, the absence of bridges over the principal rivers and the soft materials of which the roads are constructed, render travel practically impossible for all wheeled vehicles.

Coast hill soils.—The soils of the steep, narrow ridges and hills bordering the coastal plain make a poor showing, when compared with those of the latter district. In texture the soils range from heavy loams and clays to coarse masses of gravel firmly embedded in a tenacious loam or clay. On the steep, almost precipitous slopes the soils are shallow and in many places devoid of any covering of vegetation, for the heavy, dashing rains easily uproot any chance plant or tree that may attempt to gain a foothold. In the southern part of the province these bare, washed places on the steep hillsides are specially noticeable, and many such places can be counted within a distance of a kilometer. About San Fernando, on the steep hill sides, the previling soils are gravelly loams, which are constantly slipping farther down the slope. Frequently the soft, slippery rock known as volcanic tuff (fine volcanic detritus deposited in quiet waters) outcrops on these slopes, and as soon as small rock particles are set free are washed to lower levels. On the more gentle slopes, and frequently on the summits of these ridges, soils of considerable depth are found. They represent the products of long-continued decomposition of the underlying rocks, whether they consist of volcanic tuff or loosely cemented beds of well-rounded gravel.

Where the soils have been derived from the fine sediments composing the tuff, they consist of heavy clay loams, stiff and tenacious. Again, where they contain considerable of the rounded gravel, they are stiff and intractable, on account of the clay in which the gravel is embedded.

Where deep clay soils predominate, good fields of upland rice were noticed, or when not in cultivation, are covered with short, thick-set grass, suitable for pasture. Where the soil covering is shallow, many large patches of the long, coarse grass known as cogon (*Imperata arundinacea*) and other varieties of coarse grasses occur.

Where the soils are thin and poor, to improve the agricultural conditions of these hills is a serious problem. In many places small clumps of bamboo are noticed. This is said to be a variety that can be utilized in building houses and for other purposes. Near the larger towns the demand for bamboo is sufficiently large to warrant devoting more attention to growing it on these hills. The cultivation of bejuco is also to be recommended. Farther inland, where the summits of the hills are broader, a more extensive cultivation of upland rice would prove profitable, for many fields were noticed that were flourishing and promised good returns. At present not more than 10 per cent of the area of these hills are utilized for agricultural purposes, and in many cases the soil conditions are so poor that no great agricultural advancement can be expected until all of the more fertile tracts of land are more thoroughly cultivated than at present. Many of these hills present problems for the forester rather than for the farmer, for good timber trees will pay better than many crops grown at considerable expense.

Interior valley soils.—These contain soils quite similar in character and agricultural value to those of the coastal plain region. Near the large rivers in these valleys, there are often long stretches of coarse sands which have little or no agricultural value at present. Such lands are seldom more than 2 meters above the level of the river and are overflowed many times each year. Often wide stretches of gravel may be found occupying a similar position with reference to the river. By far the greater part of these valleys possess heavy silt loam soils, to a depth of a few meters. These soils are dark colored and are of lasting fertility, for each year they are usually overflowed, and a slight amount of silt and fine sediment is deposited, which helps to enrich them. Some variations, from finer to coarser grades of silt and sand, are noticed in the soils of the various parts of these valleys, but usually there is considerable uniformity in their texture. These lands are well adapted to the growth of sugar cane, but the few fields noticed were not in fine condition, on account of improper cultivation of the soil and lack of attention to the subsequent cultivation of the growing crops of cane. Rice and tobacco are the principal crops, and one crop of each is raised during the year. The tobacco is planted shortly after the rice crop is harvested at the close of the rainy season; good yields of rice are produced and the lands are considered fine tobacco lands, but the quality of leaf grown does not compare with the finest products of the Cayagan valley in northern Luzon.

The tobacco grown about Naguilian is well spoken of and commands a much better price than that grown near the seashore. But little attention is paid to the selection of seed, while methods of preparing the soil, cultivation and curing the harvested crops, are crude and can not be expected to produce the finest kinds of tobacco. About the houses of the richer class of people a number of cacao trees are usually noticed that thrive and produce well. These furnish the family with sufficient chocolate for its own needs, but seldom is enough produced for export, even to the near by village markets. The same remarks apply to limited crops of coffee grown in the yard about each farm house.

Mountain range soils.—The mountain ridges and peaks possess soils totally unlike any of those previously mentioned. Except on the steepest slopes, the soils are deeper, and fewer bare rock surfaces are found. Many bowlders are found scattered over the slopes in places, but these are seldom in sufficient numbers to seriously injure the value of the land. The soils are usually of a soft unctuous clay to a depth of 1 or 2 meters on the more level portions of the slopes and summits. This clay is of a decided red color, and exceedingly well drained for a soil containing so high a percentage of clay. While this soil will retain a great amount of water, yet it readily allows its passage, and within a few days after heavy rains is again in fair condition for cultivation. On the slopes the soils are of a yellowish color and, while soft and clayey, are not so heavy nor is the depth of soil so great. In forests the depth of rich dark-brown loam often exceeds one-third of a meter. Both of these classes of soil have been derived from the underlying rocks by the slow processes of rock disintegration and decay. In weathering under the action of atmospheric decay, the rocks frequently weather in concentric rings and the harder portions are thus left as well-rounded bowlders, which are scattered about on the surface and wholly or partially buried in the soil itself.

The rocks from which these soils are derived are all of volcanic origin, and some of them are undoubtedly volcanic dust and ashes that have been deposited in quiet water.

The red clays and yellowish clay loams are fertile, but on account of their heavy character need thorough cultivation to realize their true producing value. In the narrow valleys are found small strips of alluvial deposits of sand, silt, gravel, and even large bowlders. These have, on account of their limited extent, comparatively little agricultural value. All such tracts are subject to overflows during periods of heavy rainfall, which may cause the rapid streams to rise several meters in a single day. Large areas of this mountainous land are lying idle and covered with a thick growth of cogon and other grasses; besides, there are also immense tracts that are as yet uncleared. Some relatively small areas are in cultivation by the Igorots, who grow fields of upland rice and sweet potatoes. Both of these crops produce well, and the yields would seem to warrant a considerable increase in the acreage planted. Some wild abacá occurs along the slopes in the forests. In the rancheria Dis-Dis fiber has been extracted and pronounced of good quality, and it was recommended at the time that the cultivation of abacá should be extended. Transportation is a serious problem with the cultivation of any crop in a region so mountainous, and where trails are so few in number and so wretched in character.

SUMMARY.

In Union Province, then, we find there are many varieties of soils, varying in agricultural value. The most valuable for farm purposes are the rich alluvial soils of the coastal plain region, and the large valleys of the interior. In the agricultural development and advancement of the province these regions should receive the most attention, and every square meter of these lands should be thoroughly cultivated before making any great expenditure of either labor or money to develop the poorer soils of the coast hills or higher mountains farther east. Both of these latter regions offer a rich field to the forester, either to preserve the existing forests so that the largest revenues can be realized from the lumber products, or to reforest the now almost barren hills along the coast with trees and shrubs that will enhance their value. Along the coast the cocoanut industry is one that deserves especial attention, for conditions are favorable for the development of a large industry. Experiments with cotton culture should be patiently carried on until they result in success or failure. With the abundance of labor the province affords an attempt should be made to introduce the tea industry, for there are large areas in the province that seem to promise success to such an industry.

Tea can adapt itself to such a variety of conditions that it should be given a fair trial, for its introduction would mean much to the province. Along the line of the rice and tobacco crops, the mainstay of the province, great changes in the yield and quality can be realized by more attention to the best varieties of seed and to improved methods of cultivation and harvesting.

SOIL CONDITIONS IN PHILIPPINE FORESTS.

In company with Mr. Gifford Pinchot, of the United States Department of Agriculture, Capt. G. P. Ahern, of the insular forestry bureau, and others, the author, under the direction of the chief of the bureau of agriculture, made an inspection tour of some of the principal forest areas in the archipelago. The party left Manila on the U. S. S. *General Alava* October 29 and returned November 21, 1902, during which time short stops were made at Paluan, and Punta del Monte; Mindoro; Caima Bay, Luzon; Palanas, Masbate; Calbayoc, Samar; Silad, Leyte; Point Bulalapui, Cebu; Iloilo; Point Obon, Negros; Santa Maria, Zamboanga, and Malabang, Mindanao; Simaluk Island; Tatan, Tawi Tawi; Bongao; Sandakan, Borneo, and Malampaya Bay, Paragua. At the most of these places short excursions were made inland, while at Mindoro and Malabang trips inland occupying several days were made. In all places where opportunity allowed, observations were made on the soils, their origin, manner of formation, fertility, general characteristics, etc. Samples were collected from several localities, which will subsequently be chemically and mechanically analyzed to throw more light upon them. It is especially to be regretted that on account of the limited time in each place the relation of the forest growth to the soils could not be ascertained, for a close relationship between the soils and certain classes of trees will undoubtedly be discovered with careful study.

MINDORO.

From Paluan a trip was made northward to Calavite ridge and return by way of the Calauagan River. On the north coast short trips were made southward on the slopes of the same ridge in the neighborhood of the Dioso River, near Punta del Monte.

Paluan is a small town situated in the extreme northwestern corner of Mindoro. Its geographical situation is at 13° 20′ north latitude and 120° 30′ east longitude. Near Paluan and adjacent to the eastern part of Paluan Bay is an extensive area of alluvial land, capable of annually producing 20,000 cavans of rice (81,818 kilos). The soils of this level tract of land consist of a light-drab colored loam, composed mostly of silvery white particles of silt and the finest particles of sand. It has a soft, slippery feel to the fingers, leaving them coated with fine silvery particles of white mica. Little or no difference is noticed in texture or color between soil and subsoil. It is a loose, porous soil, possessing good natural drainage and, on account of its loamy character, is easily stirred and cultivated. It contains but a small amount of humus, although it is the result of continued deposition of small particles of sand and silt in quiet, shallow waters. It has been washed from the hills by rains and deposited by the various rivers surrounding Paluan Bay.

It is best adapted to rice culture, for on account of its low position it readily retains the abundant rains of the wet season. In the higher portions of this tract of land sugar cane would thrive well; but the present low price of sugar would not warrant the introduction of this crop. A few straggling cocoanut trees were observed and the planting of small groves, it is thought, would be profitable. A few abacá plants were also noticed, but these were in a sickly condition and produced little or no fiber. The cultivation of abacá is not to be recommended, on account of the pronounced wet and dry seasons. Rice is the crop best suited to this area, and with the abundant water brought in by the small streams two crops per year could be easily grown, since the present supply does not suffice for the local demands.

On the north side of this alluvial plain, entering the hills, soils of an altogether different character are encountered. The change is distinct and at once remarked. The silvery, silty soils are replaced by soils of a decided red color, filled with angular pieces of broken micaceous rock. On the steep slopes the covering of soil often exceeds but a few centimeters, and even this is filled with fragments of the rock from which it is derived. These red soils are composed of about equal proportions of silt and clay, with some sand, and may be classed as clay loams. On the steeper slopes the rains soon percolate through them and, on account of the character of the underlying rocks, they become dry and compact, even after copious rains. On the more level portions of Calavite ridge the conditions have favored a greater accumulation of soil; hence they are more retentive of moisture and possess more value for agricultural purposes. On the steep slopes the soils possess little value as farm land, but support a fair growth of forests in which bejuco (rattan) is abundant. On the higher, more level portions of the ridge the vegetation is more dense, especially the undergrowth. These soils are derived from the slow decomposition of the underlying rocks. Slowly the rocks crumble and fall to pieces and, when thoroughly decomposed by the atmospheric agencies constantly at work they appear as soft, red clay loams, through which are scattered occasional fragments of the harder parent rock. The rocks which give rise to the soils of the mountain slopes and ridges comprise a series of micaceous, quartose, talcose, and chloritic schists. They belong to the older series of geological formations that have been changed and altered by subsequent processes. They consist chiefly of silicia, white mica, and iron-bearing silicates.

In the few cleared areas among the forest growth some fields were noticed that are at present covered with cogon grass. In no places were cultivated fields noticed, for the scattered tribes inhabiting the mountains practice agriculture on a limited scale. Where the slopes are not too precipitous the soils would be found to be fairly productive and, by proper cultural methods and fertilization, could be made to produce good crops of upland rice, corn, beans, and sweet potatoes. On the steepest slopes it would be folly to attempt any cultivation whatever. In spite of the heavy covering of forest and the ever-present decaying leaves and tree trunks and vines little or no humus can be detected in the soils.

The forest growth abounds in many of the more valuable woods of the islands, and among others may be mentioned lauan, bocboc, tindalo, and antipolo. The balete is especially common and many of large size were noticed, in some cases completely surrounding the tree upon which they cling for support.

On the northern side of Calavite ridge the slopes are steeper, and many sheer precipices were observed. Accordingly, the conditions allowing the soils to accumulate are not favorable, and shallow, stony soils, similar in character to those already mentioned, are found. Near the highest point in the ridge, which attains an elevation of about 700 meters, the rocks contain a larger proportion of quartz; hence the soils are shallower and contain more rock fragments. Near the mouth of the Dioso River there is a flat about 250 meters in width consisting of a heterogeneous mass of bowlders and smaller ground-up rock débris. On this flat the tree growth was characteristic and contained a generous sprinkling of molave and calantas. Near the stream bed was observed a remarkable example of the casts formed by worms or other burrowing animals. Many of the tubes or casts were 20 centimeters in height, the outside diameter averaging about 2½ centimeters, while the inside opening measures a little less than 1 centimeter. These tubes are composed of a mixture of micaceous sand and silt, such as is deposited by the river in quiet pools. They may be found completely covering the ground for many meters. The effect of such grinding and working over and over the small particles of sand and silt is to grind them smaller, while the action of the acids, secreted by the animals who built the tubes, undoubtedly acts to further dissolve and reduce the size of the rock particles. At the time when these castings were observed none of the animals who built them could be found after considerable search; and yet, three months prior to this time, we were informed they were not there.

CAIMA BAY, LUZON.

In the neighborhood of this bay, in Ambos Camarines Province, some observations were made on the soils and rocks from which they are derived. The bay is situated at 12° 40′ north latitude and 123° east longitude. The climate in this part of Luzon corresponds to that of many of the southern islands. The rainfall is well distributed over the entire year, without pronounced wet and dry seasons. Near the entrance to the bay great, chalky limestone cliffs stand out in bold relief, and it is from the weathering of this soft limestone that the soils are derived. The soils bear little resemblance to the parent rock. They consist of black, waxy loams, heavy and tenacious in texture, but rich and of lasting fertility. The top soil averages about 15 centimeters in depth, overlying a subsoil of yellowish brown clay. Usually rock is encountered about 50 centimeters from the surface, while the surface is thickly strewn with various-sized fragments of soft, yellowish limestone. The manner in which limestones weather into soils is somewhat different from other rocks. Calcium carbonate, the chief ingredient of limestone, s readily attacked and dissolved by warm rains, especially since it contains carbon dioxide. So that the purer a limestone is the more readily it will dissolve in a region where the rainfall is abundant. The soils, then, represent the insoluble particles of the original rock, mixed with vegetable matter in varying stages of decomposition.

The natural fertility of these soils is shown by the luxuriant growth of large trees and underbrush they support in the natural state. Among the more valuable timber trees were noticed many molave, narra, pili, lanutan, ligas, dungan, and oranga. If the forest growth be cleared where free from stones and of sufficient depth, these soils will amply repay the extra cost of plowing and subsequent cultivation. All farming operations are difficult in such soils, for they are exceedingly sticky and tenacious; but for certain crops they are very valuable. Fruits thrive well on these soils, and they are natural pasture lands. Corn, tobacco, and vegetables will be found to yield large crops. Near this locality, on black, waxy, limestone soils, considerable abacá is grown, and it is reported that the crop pays well. Coffee does not succeed well, but cacao should make a good growth and bear well.

PALANAS, MASBATE.

Palanas is situated on the southeastern coast of Masbate, in 12° 10′ north latitude and 123° 55′ east longitude. It is a small town, that exports little or no agricultural or forest products. Low hills lie west of the town, that farther inland merge into a well-defined central mountain region. The rocks of the hills along the coast are soft, whitish yellow limestones, that weather into soils, very similar to those described as occurring at Caima Bay, Luzon. Where conditions for the weathering of these rocks are favorable, a rich, black, waxy, tenacious clay loam has resulted. At an average depth of 30 centimeters, on the more level slopes and hilltops, the soils grade into yellow clays that are soft and unctuous, and possess little or none of the sticky or waxy nature of black loams on the surface. On the steepest slopes and highest parts of the hills, the soils are shallower and a considerable number of partially decayed limestone fragments are scattered about on the surface. Where the soils are deep and free from such pieces of limestone, there can be no doubt of their lasting fertility. While difficult to plow and stir, even with the scant cultivation given them by the natives, they produce good crops of sweet potatoes, corn, beans, and the other crops that are planted in limited quantities. Some tobacco is grown, but only to a small extent, and for local consumption. Tobacco makes a rank growth on such soils, but for chewing tobacco and cigar fillers good results can be expected, with proper seed and modern cultural methods. Such soils are especially desirable for corn, cotton, fruits, and vegetables of all kinds, while pasture grasses make a good growth the entire year, especially in this part of the archipelago, where the annual rainfall is well distributed. Near Palánas were seen camote (sweet potato) fields, scattering clumps of cocoanut trees, and large areas overrun with a dense growth of the coarse cogon grass. A few kilometers from the village, on similar soils, a fine quality of abacá was reported, and some larger fields of tobacco than at Palanas. From all reports, similar soils are found in much of the coast country of eastern Masbate, while in western Ticao, from the character of the low, white, limestone cliffs, it is to be inferred that the same soil conditions prevail.

CALBAYOG, SAMAR.

At Calbayog the soils were examined along the coast for a few kilometers north of the town. Calbayog's geographical position is 12° 6′ north latitude, 124° 37′ east longitude. It is one of the important abacá shipping points of western Samar, although but few large plantations are near the city. North of Calbayog, even within a distance of a few kilometers, several different classes of soils can be found. Near the coast sandy soils prevail, while the same character of soils are found near Calbayog. These consist largely of medium grade sands derived from broken and finely divided coral reefs that have been subjected to the grinding action of the waves. White in color, compact, and apparently containing but little of those elements that are essential to plant growth, these soils support large groves of cocoanut trees. Small patches of corn, beans, and sweet potatoes are also raised. Farther north from Calbayog, soils are found that may be described as yellow clay loams. With the exception of occasional abacá plants, little is seen on these soils but a heavy growth of cogon grass. They are only fairly productive and closely resemble large areas of yellow clay loam soils that the writer has observed in the hills east of Catbalogan, the capital of the island, about 35 kilometers south of Calbayog. In this locality the soils are derived from the slow weathering of rocks that are apparently calcareous sandstones.

Again, in the low country along the coast north of Calbayog, heavy, reddish, sandy loam soils were observed. These soils, in spite of the large percentage of sand they contain, are stiff and tenacious, and can be cultivated with little less difficulty than clay loam soils. They are undoubtedly residual soils—that is, they have been derived in situ by the slow processes of rock decomposition. They can be classed as less fertile than the yellow clay loams and much stronger and more fertile than the coral, sandy soils along the shore. No cultivated fields were seen, but a few scattered clumps of forest and some areas of cogon grass. Scattered among the patches of cogon grass were noticed many specimens of the Toob tree that grows to a great height.

SILAD, LEYTE.

This is a small barrio belonging to the pueblo of Villaba on the northwestern coast of Leyte. It is situated in 11° 13′ north latitude and 124° 23′ east longitude. Along this portion of the northwestern coast of Leyte, the country is broken and rather high hills, from which the forest has long been cut away, reach to the very water's edge. Farther inland, to the east, are high ranges of mountains that are undoubtedly of volcanic origin, judging from the bits of rock carried seaward by some of the small streams. Near the coasts, however, are soft, yellowish white limestones, similar to those mentioned as occurring in Ambos Camarines Province, Luzon, and on the island of Masbate. These weather into yellowish-brown clay soils, somewhat similar to the soils of the above-mentioned localities. The surface soils are dark clay loams that possess none of the waxy quality of the soils of Masbate and Ambos Camarines. At an average depth of 15 centimeters below the surface the clay loams grade into soft, unctuous clays of a decided yellow color. The subsoils contain a much higher percentage of clay than the soils; in fact, in places they consist of but little else except the finest particles of clay. In the small gullies along the trails, often at a depth of 1 meter, the clays can be observed resting on the limestones from which they are derived. The surface soils contain a fair amount of humus, while the subsoils add strength and body to the soils, by acting as reservoirs to store up and conserve the moisture necessary for the growing crops. Some fields of upland rice were noticed—a crop that should succeed nicely on the rolling lands along the coast. Abacá fields were also noticed, that are said to produce a good quality of fine white fiber. Small patches of sugar cane, that appeared in a flourishing condition, were also seen. From the growing crops and the general appearance of the natural growth, these soils have every indication of being rich and fertile. Scattered Toob trees were seen, that attain a height of at least 40 meters. On one of the hills overlooking the sea a small cocoanut grove realized for its owner some share of profits from the sale of tuba, daily collected from the freshly cut flower stalks. The soils of this portion of Leyte, while not so fertile as some of the districts above mentioned, are sufficiently rich to warrant good returns to the farmer who bestows his time and labor upon them.

POINT BULALAQUI, CEBU.

This locality is situated at the extreme northern end of Cebu in 10° 18′ north latitude and 124° 3′ east longitude. In this portion of Cebu the country is low and rolling, with no pronounced difference in elevation. The forests have long since been cleared away, and much of the country is under a good state of cultivation. Here, as at Ambos Camarines Province, and at Palanas, Masbate, soils were found derived from the weathering of soft, yellowish limestones. Near the seashore there is a slight admixture of beach sand that has been blown inland a short distance; but farther from the shore the soils are heavy, black waxy clay loams to a depth of 15 centimeters.

The black clay loam is underlaid by a soft yellow clay that, in turn, grades into soft, partially decomposed limestone. On the level tracts of land no stones were noticed, but on the hills and slight knolls the soils are shallow and many fragments of the parent rock are scattered about. In such places the soil has little of the value of the more level areas. The heavy, waxy character of these soils makes them hard to plow and cultivate, but their fertility is sufficient to produce fair crops with the scant scratching which constitutes the present system of cultivation. With thorough plowing good yields of many fruits and crops could be harvested. Small patches of corn were noticed, of only fair quality; also sugar cane, that was too thickly planted, and plainly showed the lack of cultivation. Upland rice and beans were also seen, and in the areas where no cultivation was practical, a heavy mat of good pasture grass was everywhere observed. Such soils make good pasture lands, while all kinds of vegetables and many fruits will flourish equally well with proper care and cultivation. Tobacco, rice, and sugar cane will also be found profitable crops on soils of such natural strength and fertility.

POINT OBON, NEGROS.

A landing was made in the small bay south of this point, in southwestern Negros, and the soils examined a short distance to the eastward. The geographical position of the locality is 9° 45′ north latitude and 122° 28′ east longitude. This portion of Negros is rough and mountainous, and but little cultivation is practiced by the people of the small barrios along the coast. Dense forests and jungles reach to the very water's edge, except in the immediate vicinity of the villages.

On the shores of the eastern part of the small bay are sandy soils, derived largely from coral sand and limestone. Small cocoanut groves and patches of sweet potatoes were noticed, that were flourishing. Farther inland was a dense growth of forest and jungle, and soils of a totally different nature were found. In the low land stony soils were found that consisted of masses of sandy loam mixed with small, angular fragments of comparatively fresh, volcanic rock. These soils are of little value for agricultural purposes, but support a heavy forest growth. On the slopes of the surrounding hills yellow loam soils of greater depth and more adapted to farming purposes were seen. These soils are derived in places from the slow weathering of volcanic rocks. On the more level slopes and summits of the ridges the soils are correspondingly deeper and possess a greater degree of fertility. In such locations farming operations could be profitably carried on, for the soils contain some humus, and the texture is suitable for storing the moisture necessary for plant growth. Samples were collected in such a location that, to a depth of 30 centimeters, consisted of rich, brown loam. Upland rice, corn, vegetables, sugar cane, and abacá would produce fair yields in such areas.

SANTA MARIA, MINDANAO.

Santa Maria is situated in the northwestern part of Zamboanga Province, Mindanao. Its position is 7° 45′ north latitude and 122° 6′ east longitude. This part of Mindanao is rough and mountainous, and the surface of the country is not well adapted to agricultural purposes. In the locality where the soils were examined extensive timber cutting is being carried on. The soils consist of shallow, coarse, sandy loams of a yellowish color that grade into broken masses of soft, partially decomposed rock.

They possess little humus and can not be classed as fertile soils. Where the original forest is allowed to remain, the slopes are protected from the washing of the heavy rains, so that, although possessing but little fertility, they readily support a heavy growth of valuable timber. Even where the forest growth has been removed but a short time, the rains have removed the soil in places, leaving the underlying rocks exposed. This soil is residual; that is, it has been formed by the breaking up and decay of the soft, purplish schists that occur in this region. On the steeper slopes no attempt should be made to farm; otherwise the soil covering would soon be removed. But on the more level portions such crops as are adapted to sandy soils would make some return to the farmer. With sufficient manure and fertilizers, vegetables would mature early and make a fine growth, while tobacco suitable for thin wrappers for cigars could be raised. In the more sheltered valleys abaca and cacao could be profitably grown.

MALABANG, MINDANAO.

From Malabang the trip was made to Lake Lanao, a distance of approximately 33 kilometers. Malabang is situated on the east side of the Bay of Illana, in the province of Cotabato. Its geographical position is 7° 30′ north latitude and 124° 6′ longitude east of Greenwich. Lake Lanao is situated in the central part of the province of Misamis. From Malabang to the lake there is a gradual rise, until at the site of the Moro fort, Binidayan, an elevation of 950 meters is reached. The greater part of the distance is through exceedingly dense jungle, in which great trees abound, while the profusion of balete and bejuco and creeping vines adds to the tangle and confusion of the jungle. About Malabang, and also about Lake Lanao, the country has been cleared for many years, and open, rolling country is the rule. Over the entire distance the soils are quite uniform and bear a striking resemblance to the famous abaca lands near the Mayon Volcano of Albay Province, Luzon. The soils of this region may be described as black, fertile, sandy loams of varying depth. Below Matalang Falls in many places the depth of black, loamy sand is 2 meters, of which the upper 30 centimeters contain a large percentage of well-rotted roots and other vegetable matter. Above Matalang Falls the depth of black, sandy loam is much less, and in the vicinity of Camp Vicars, in places, does not exceed 15 centimeters. The black, sandy loam varies in size from fine powdery-like sand to nicely assorted sand of 2 millimeters in diameter. This sand is generally clearly stratified in shallow bands, and each band is generally uniform in size. Frequently fine and coarse bands of sand are interbedded together. Even where the coarsest grades of sand occur, it was noticed that the sand would retain a vertical position in road cuts and not slump down in the manner so characteristic of beach or river sand. This sand is usually rounded or slightly angular, and on closer examination each particle closely resembles the ashes and bits of slag around furnaces. It is evidently the slightly weathered ashes and dust of near-by volcanoes, and the source of the material is undoubtedly from some one of the numerous volcanic peaks that lie east of the military road in the vicinity of Butig Mountain. The entire region is one of considerable volcanic activity, and Lanao is probably a crater lake. Violent earthquakes are common to this part of Mindanao, and on many of the higher mountains and hillsides can be seen the paths of landslides that have swept down, entirely removing the heavy growth of trees and jungle for many meters in width.

In places the black sands rest directly on dense or vesicular volcanic rock. Again, they rest on a soft, yellowish red clay that has probably been derived from volcanic rock by slow decomposition processes. The line of demarcation between the black sands and reddish clays is sharp and distinct, plainly showing no relation between the two.

To one not familiar with the fertility of soils derived from volcanic ashes and cinders, these soils appear of little agricultural value; but such is not the case. They are wonderfully rich and fertile, although it can not be said that they would continue so after long periods of hard farming. For many years, however, these soils will be found to be very rich and will produce good crops of anything suited to the climatic conditions of the region. At the lower elevations wild abaca was observed, and it would undoubtedly succeed at elevations not greater than 400 meters above sea level. Corn would succeed well, and fruits and many vegetables. About Lake Lanao considerable upland rice is grown and, with attention, this crop should prove a profitable one. Coffee, considered especially fine by the lake Moros, is grown in limited quantities at the higher elevations. In the forests many large trees of several valuable varieties are found, while the gutta-percha tree and rubber tree are native to the forests of this part of Mindanao. In the cleared country about the lake a considerable advancement along agricultural lines is to be expected, unless the earthquakes, of daily occurrence, are to be taken as a warning that this beautiful country may at any time become untenable through the opening of the many volcanic vents that certainly have not long been quiet.

TATAN, TAWI TAWI.

A landing was made on the northwestern coast of Tawi Tawi, at the site of the former town of Tatan. This town was destroyed in 1889 by the Spaniards, and only a few ruins tell of its former existence. The geographical location is 5° 15′ north latitude and 120° 3′ east longitude. To the east of Tatan, in the center of the island, are great perpendicular cliffs that form so striking a feature of Tawi Tawi and the islands south of it. The rocks forming these cliffs are plainly the result of violent volcanic activity. They are termed agglomerates, and consist of angular and broken fragments of various kinds of volcanic rock imbedded in volcanic lavas and muds. Many areas of such rock are found in the archipelago and when deeply weathered by atmospheric agencies they give rise to characteristic soils. The soils are soft, unctuous clays, soft and slippery to the touch, and containing no perceptible amount of coarse sand whatever. In fact, they consist of almost pure clay of a bright red color, and in dense forests only the uppermost layer is darkened by the admixture of a slight amount of humus. In spite of the great percentage of clay they contain, they readily allow the passage of rains through them, and even after prolonged, heavy rainfalls soon drain out. To thoroughly plow them is not especially difficult, for the clay is yielding, if cultivated at the proper time. For rice, either upland rice or flooded rice, and for grazing lands these soils are admirably adapted. Corn, sugar cane, and tobacco will succeed fairly well. Coffee, a deep-rooted plant, thrives well on red clay lands of this character. In their natural state a heavy forest growth is the result, in which many valuable timber woods were noticed.

In addition, there was a thick tangle of underbrush and creeping vines, in which bejuco and balete played a large part. No cultivated lands were seen, but some abandoned areas near Tatan were noticed, that were thickly covered with a rank growth of cogon grass.

PANCOL, PARAGUA.

Landings were made at Pancol and Limonancon, in Malampaya Sound, in northwestern Paragua. Pancol is situated on the eastern shore of the sound in north latitude 10° 53′ and 119° 28′ longitude east of the Greenwich meridian. Limonancon is located near the mouth of the sound. This portion of the island is quite rough and broken and so thickly forested that but little land is available for agricultural purposes. The soils about these two villages are quite similar in appearance and general characteristics, and it is to be inferred that the soils of much of this portion of the island are similar. Near Pancol the soils consist of yellow, sandy loams which on the slopes are shallow, contain but little humus, and can not be classed as rich farming land. On the more level places and in some of the small cleared fields northeast of Pancol the soils were heavier in texture, deeper, and contained some humus. They were much better adapted to farming purposes, although not very fertile soils. In much of the land covered with forest the soils did not exceed 25 centimeters in depth before rock was encountered. On the surface are innumerable small fragments of the hard hornstone or siliceous rock, from which the solis are derived. The rock which weathers into these soils is either of volcanic origin or a metamorphosed sedimentary rock. From the high percentage of quartz it contains, it weathers with exceeding slowness; nor can the resultant soil be rich in the elements of plant food, since the rock itself is so poor in the substances which furnish nourishment to growing plants. The rock is of a reddish color, exceedingly compact, and fine grained. The shape of the mountain on the west coast of the sound is undoubtedly that of a volcanic cone, so that it may be reasonably inferred that the rock is a felsite or acid lava. Upland rice was the only crop grown to any extent on these soils, and only small fields of this were seen. Some small patches of sweet potatoes were also observed. From the stony character of most of this soil and from the rugged nature of the topography in the vicinity of Malampaya Sound, at least, it is not advisable to clear the rich forest growth to attempt to conduct farming operations. On many of the steeper hills so much bare rock is exposed that no improvement could be made unless at the greatest expenditure of time and labor; besides, in the more favorable localities, the soils would need frequent applications of fertilizers to make them productive after continued cropping.

SOIL SURVEY OF THE BATANGAS AREA, LUZON.

INTRODUCTION.

The object of a soil survey, quoting from the field operations of the Bureau of Soils for 1901, is to provide an accurate basis for the adaptation of soils to crops. It seeks to present as clearly and as forcibly as possible the conditions of an area in such a manner as to make it possible for prospective settlers to take up lands suited to certain crops, and to enable present owners of land to learn from the experience of other localities what crops are best adapted to their own soils and climatic conditions. In the present struggle for commercial supremacy, the importance of such accurate knowledge of agricultural conditions is becoming daily more evident. No community and no nation can afford to waste its time and energies in the pursuit of interests to which its conditions are unsuited; nor, on the other hand, can it afford to lose any chance of inaugurating and developing those interests for which it is peculiarly adapted.

A soil survey aims to eliminate, to some extent, such waste in the line of agriculture. Its most valuable function is undoubtedly the improvement of existing methods, so that larger yields of our staple crops can be secured, although more showy results are gained in the development of special industries.

A portion of Batargas province was selected and the soils classified, according to their agricultural value and character, and the distribution of these various classes of soils shown on accurate, large scale maps. Maps made by the engineering department of the Division of the Philippines in 1901 were used to project the work upon. These maps are on the scale of 1 centimenter to 0.634 kilometer. They show accurately the location of all roads, trails, rivers, streams, mountains, cities, villages, and barrios. The area surveyed is situated in the southern central portion of the province and contains approximately 484 square kilometers. In the following table are given the size of area, the rate surveyed per day, and the cost per square kilometer, including the cost of transportation, subsistence, and salaries of the men employed. A few areas surveyed by the Bureau of Soils of the United States Department of Agriculture during the field season of 1901 are also given for comparison.

Area and cost of soil surveys.

Batangas, P. I.:		
Area surveyed	square miles	[a]290
Rate per day	do	[b]8
Cost per square mile		[c]$1.68
Bedford, Va.:		
Area surveyed	square miles	632
Rate per day	do	4.7
Cost per square mile		$2.01

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[a] 483.9 square kilometers.

[b] 12.9 square kilometers.

[c] $1.04 per square kilometer.

Prince George County, Md.:		
Area surveyed	square miles	480
Rate per day	do	2.5
Cost per square mile		$3.41
Salem, N. J.:		
Area surveyed	square miles	493
Rate per day	do	6.2
Cost per square mile		$1.44
Lake Charles, La.:		
Area surveyed	square miles	202
Rate per day	do	2.4
Cost per square mile		$3.71
Allegan County, Mich.:		
Area surveyed	square miles	828
Rate per day	do	5.8
Cost per square mile		$1.44

The Batangas area lies between 13° 40′ and 13° 59′ north latitude and 120° 59′ and 121° 14′ east longitude. It contains the capital city, Batangas, the important town Lipa, as well as the smaller towns San Jose, Ibaan, Cuenca, Bauang, Rosario, and Taysan. Fine wagon roads connect the more important towns, making transportation an easy matter during the greater part of the year. Batangas has long been known as one of the foremost agricultural districts of the islands. Considerable quantities of sugar cane and corn are annually grown in addition to many minor products, such as coffee, abaca or manila hemp, cacao, and garden produce.

CLIMATE.

Although Batangas Province is usually considered one of the southern provinces of Luzon, the climatic conditions correspond closely to those of the northern and western portions of the island. No meteorological stations are located in the area under consideration, but a complete set of records has been kept at Punta Santiago in Batangas Province, distant about 30 kilometers from Batangas city. The rainfall records for this station are for the period beginning in 1886 and ending in 1897.

Rainfall for Punta Santiago, Batangas Province.[a]

	Millimeters.		Millimeters.
January	6.5	August	239.9
February	.2	September	321.5
March	5.7	October	120.8
April	4.6	November	101.6
May	99.4	December	57.5
June	186.9		
July	368.2	Total	1,517.5

These figures show a distinct wet and dry season, in common with other localities on the west coast of Luzon. During the period from June to October the rainfall amounts to 1,234 millimeters, more than four times as much during the period from November to May, when the rainfall only amounts to 283 millimeters. July, August, and September are the months of the greatest rainfall, while January, February, March, and April are the driest months, during which time the rainfall does not exceed 20 millimeters. Rainfall records taken at the city of Batangas would doubtless correspond closely to the figures given in the above table; but, in the upland country about Lipa, the rainfall is appreciably greater while in the mountainous region in the southeastern part of the area, in the foothills of Malarayat Range, as well as about Mount Macolod, showers are of almost daily occurrence, even during the months of least rainfall.

The temperature records for Batangas city are quite similar to those for Manila, and the records for the latter place are given in the following table:

	Monthly mean.		Monthly mean.
January	25	August	27.1
February	25.4	September	26.9
March	26.9	October	26.9
April	28.3	November	26.1
May	28.5	December	25.2
June	27.8		
July	27.1	Annual mean	26.8

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[a] P. 212, Vol. IV, Philippine Commission Report 1900.

Comparing the table of monthly means with the figures given for the annual mean temperature, 26.8, it will be seen that there is little departure from these figures. December, January, and February are the coldest months; April, May, and June the months of greatest heat. In the more elevated portions of the area the temperature is appreciably cooler, especially the night temperatures.

The monsoons blow with great regularity; the northeast monsoon from November to May, the southwest monsoon from June to October. The latter brings the moisture-laden winds from the China Sea and causes the abundant rainfall of the wet season. In passing over the high ranges of mountains near the Pacific coast, the northeast monsoons lose their moisture content; consequently they sweep across the province as dry, hot winds.

The unequal distribution of rainfall in the area is not the most favorable for the production of all classes of agricultural products; for frequently, as during the year 1902, the rainy season is light, and the long months of drought seriously affect the growth of such crops as sugar cane, corn, and tobacco. For the small garden crops irrigation is frequently practiced, but for the larger field crops this is hardly practicable, so that in such years of drought the entire crop is lost.

PHYSIOGRAPHY.

In discussing the prominent surface features of the area, for the sake of convenience they may be divided into three classes—coastal plains, upland plains, and mountains.

Coastal plains.—Bordering Batangas Bay from west of Bauang to the barrio Tabangao south of Batangas, varying in width from 1 to 2½ kilometers, is found a well-marked plain. This plain is a distinct physiographic unit and doubtless owes its origin to the gradual elevation that is taking place along the west coast of Luzon. On the landward side it comes in direct contact with the gradual sloping upland plains that comprise by far the greater portion of the area. The city of Bauang is located at the junction of the coastal plain with the upland plain, while Batangas lies very near the junction of the two plains. The coastal plain lies but a few meters above mean tide level. It is characterized by large areas of salt marsh land, where the natives engage largely in the manufacture of salt, and low lands with wet muck soils and small tidal streams and arms of the bay. Along the Calumpang River, near Batangas, the alluvial plains of this river are extensive, and properly belong to the coastal plain. In this river the influence of the tides is felt to a short distance below Batangas. The small streams crossing this plain emerge from their deeply cut, narrow canyons, and occupy wide stream courses but a few meters below the general level of the plain.

Upland plains.—Bordering the coastal plain and stretching northward and eastward for many kilometers come the broad plains that have been spoken of as upland plains. This physiographic feature comprises more than two-thirds of the entire area. Where it comes in contact with the coastal plain, its elevation above sea level does not exceed 10 meters; but from this elevation it gradually rises northward to a few kilometers north of Lipa, where an elevation of more than 300 meters is attained. From here it begins to slope toward Laguna de Bay. Hence the drainage for the greater part of this plain is southward to Batangas Bay, and only a small portion of the rainfall drains into Laguna de Bay. This plain was formerly a continuous sloping plain, but stream erosion has considerably modified the surface. Remnants of the former continuous plain, unmodified by stream cutting, are observed in the broad level east of Taysan and New Rosario. Here for many kilometers but little change in elevation is noticed. Near the drainage divide about Mataas na Cahoy the rolling character is strongly pronounced. Along the tributaries of the Calumpang River south of Ibaan occur the most broken areas of this broad plain. Here the streams have deeply cut narrow gorges, from 50 to 100 meters below the general upland level, and the country consists of a succession of narrow winding ridges between the streams. Nearly all of the streams, a few kilometers from their source, rapidly cut narrow channels in the soft rocks, making road building costly and laborious. Many roads built during the Spanish regimé cross these narrow canyons by means of handsome stone arches, which still remain intact, in spite of the numerous earthquakes that have occurred in the many years that have elapsed since their completion. From numerous points, owing to the open character of the country, the greater part of this plain can be seen. The entire portion of this plain is well drained, and only in the neighborhood of old Rosario is there any tendency to imperfect drainage conditions. Rising higher than the surrounding country are small, rounded hills that may properly be considered with the higher mountain ranges and peaks that will now be described.

Mountains.—Several prominent groups of mountains and many smaller isolated peaks stand out in bold relief, when contrasted with the rolling upland plains, and add scenic beauty to the area. The largest group of mountains is situated in the southeastern part of the area. This group contains many large peaks and smaller spurs and outlying hills. The group belongs to the region usually spoken of as the Loboo Mountains, and prominent peaks are Mount Biga, Mount Cabanag, Mount Pinagacutan, Mount Calumpit, Mount Sarumcastila, and others. The highest of these reach elevations of more than 700 meters above sea level. The turbulent streams in this region flow through canyons filled with huge bowlders.

Mount Macolod, rising abruptly from the shores of Laguna de Bombon, forms one of the landmarks of the province. On clear days it can be seen from Manila Bay, and many other localities equally distant. A central peak, with prominent spurs leading from this, form the mountain. The town of Cuenca is located at the foot of one of the prominent spurs on the southern side of the mountain. The elevation of the central peak probably exceeds 800 meters, while the total area does not exceed 10 square kilometers. The Malarayat range of mountains, lying to the east of Lipa a short distance, stand out in bold relief, but only the outlying foothills and spurs are situated within the limits of the area. The elevation of these foothills is only a few hundred meters above the country surrounding it.

In addition to these more important mountain peaks and ranges are the several smaller peaks that have been referred to. The largest of these is Mount Vigain, situated a short distance to the southeast of Cuenca. From its rounded contour and the flat character of the summit it is undoubtedly a former volcanic cone. Mount Tumbol, at the foot of which the new town of Rosario is located, is a small rounded peak that rises from a level plain. It has long been considered an extinct volcanic peak. Other isolated peaks, somewhat similar to the ones just mentioned, are the peak near the barrio Añilao south of Lipa and the prominent hill a short distance west of Ibaan.

GEOLOGY.

The geological features of the region may be briefly discussed under the same head as the physiographic features.

Coastal plains.—Composed of soft, unconsolidated silts and muds that have been recently deposited by the various streams that empty into Batangas Bay. Occasionally, in periods of great rainfall, the Calumpang River overflows its channel and contributes something toward the upbuilding of the littoral plain; but by far the greater part of the area consists of the sediments that have recently been deposited in shallow waters along the shore, and the gradual uplifting of this part of the island has formed the coastal plain into its present condition.

Upland plains.—Everywhere, underlying the soils of the upland plains but a short distance from the surface of the ground, are found distinctly stratified layers of soft grayish rocks, known as volcanic tuff. The same layers of this rock may be observed outcropping along the roads for distances of many kilometers. The layers vary somewhat in thickness and composition. By far the greater part of the material consists of a fine grayish silty material, partially solidified. From the continuity of the beds it is evident that the material must have been deposited in quiet waters. In the deeper cuts, nearly 100 meters below the general upland level, many fine layers of nicely assorted black volcanic angular sand were observed. Along the Calumpang River, below Ibaan, advantage has been taken of the fine exposure of the soft gray rock and many large quarries furnish building stone for the city of Batangas. While many of the beds are remarkably uniform in texture, some contain variously assorted material and leaves of plants are frequently found imbedded in the different rock strata. By far the greater part of this material has come from the Taal Volcano, situated on a small island in Laguna de Bombon, but a short distance northwest of Mount Macolod. The rocks represent the finer ashes and detritus ejected from the volcano and deposited at a time when all of the great valley, from the Lingayen Gulf to Batangas Bay and Tayabas Gulf, was an open sea. The tuff is andesitic; that is, it belongs to the class of rocks known as andesites—rocks only moderately rich in silica. These tuffs decompose readily under the weathering influence of the atmosphere and offer but little resistance to stream cutting as all—even the minor streams—flow through deeply cut channels.

Mountains.—In the mountainous areas rocks somewhat similar to those just described and many other classes of rocks are also found. In Mount Macolod volcanic tuff is abundant, but it contains a larger percentage of larger and coarser material, and is more compact and harder than the tuff of the upland plains. In addition, hard reddish and black volcanic andesite rocks are found. The same rocks are also found in the southeastern part of the area, and the tuffs of this region may owe their origin to some one of the peaks of this chain of mountains, for Mount Loboo is frequently spoken of as a former volcanic crater. The same remarks apply to the rocks of the Mount Malarayat range, a peak of which, known as Susong-Cambing, is supposed to be an extinct crater. In the smaller peaks and isolated mountains, two of which have been spoken of as former volcanic vents, only pyroclastic tuffs are found, although these are considerably harder and more resistant to weathering than the soft level strata underlying the upland plains. In the small mountain just south of the barrio Malabo, large outcrops of white crystalline limestone were seen. In former years this stone was burned to considerable extent for lime, and several abandoned limekilns were noticed. Limestone occurs along the beach near Pinamucan and east of this barrio. These areas are probably far more recent than the first-mentioned area of limestone near Malabo. Two of these areas give rise to the distinctive black waxy clay soils that will be described.

SOILS.

Eleven types of soils of varying agricultural value and differing widely in their origin and method of formation were recognized and mapped. Of the alluvial soils the Calumpang sandy loam and the Calumpang loam are the most valuable for general farming purposes. Of the residual soils derived in place by the slow decomposition of the underlying rocks, the Lipa loam possesses the greatest natural advantages, while the Talumpoc clay loam is the poorest of all the soils.

Ibaan clay loam.—This soil formation occupies by far the greatest area of any of the soils surveyed. About Ibaan this soil occurs typically developed; hence the name of Ibaan clay loam was chosen for the soil. The soil consists, to an average depth of 12 centimeters, of a reddish brown tenaceous clay loam that is difficult to till and cultivate. In plowed fields the great masses of firmly-baked clods plainly show the stiff unyielding character of the clay loam. These clods are in many cases almost as hard as the underlying rocks and can only be broken with the greatest difficulty. Little sand can be detected in the soils, although they frequently are granular, owing to the presence of firmly cemented particles of the rocks from which they are derived. Even on some of the more level areas where considerable depth of soil is to be expected shallow plowing brings to the surface broken bits of the underlying rocks. The subsoil consists of heavy stiff clay loam of a more reddish color, and, at an average depth of 30 centimeters from the surface, grades into partially decomposed underlying grayish and brownish rocks. In many cases the total depth of soil and subsoil does not exceed but a few centimeters, while in more favorable localities the depth of soil and subsoil attains a depth of 80 centimeters. Generally, however, the Ibaan clay loam is a shallow soil that at the present time possesses little natural fertility. Plowed when wet it forms large clods that soon bake and yield but little plant food to the growing crops, unless with great expenditure of labor the soil is reduced to a fine state of tilth. This soil type occurs in a large unbroken area north of Batangas and Bauang, occupying large areas about San José and Ibaan. Away from the larger streams the surface is generally level or gently rolling, but near the junction of the principal streams the country is greatly broken and not well adapted for farming purposes. The entire area slopes gradually northward and eastward and has been elevated above sea level a sufficient length of time for the drainage to become well established. No undrained areas occur in the formation, and, except in seasons of greatest rainfall, tile drains or open ditches are unnecessary.

From the uniform nature of the underlying strata of consolidated volcanic silts and muds sloping toward Batangas Bay, it is not remarkable that similar soil conditions should prevail over such wide areas. These rocks, uniform in character and composition, have weathered through the decomposing agencies of the atmosphere into the stiff, unyielding clay loams that comprise this formation. Undoubtedly, when the original forest growth was first removed, many centuries ago, the depth of soil was greater and more loamy and fertile in character, owing to the presence of humus and other vegetable remains, but the washing of the rains and imperfect cultivation have long since destroyed the humus and left them in their present impoverished condition.

Many crops are cultivated, the principal ones being sugar cane and corn. Many fields of the former crop were seen about Ibaan, while scattered patches of corn are found over the entire area. From the care and attention given cane crops, large yields can not be expected, and the primitive methods employed in extracting the juice and sugar making would not seem to warrant the cultivation of this crop, with the present low prices of sugar in the world's markets.

The yields of corn are not large and, during seasons of extreme drought, do not justify the preparation of the land; moreover, the swarms of locusts which almost annually sweep over the province are a menace to the crop, which must be reckoned with.

Many small patches of tobacco are grown in different parts of the area, but only about San José does the crop assume any considerable proportions. The more loamy pieces of land near the houses are selected for the crop, which seldom exceed a hectare in extent. While some fields were seen that give promise of better results, with careful selection of seed and proper cultivation, the majority of the fields show plainly the lack of care and attention, for the leaves are badly torn and eaten by insects. Little attention is paid to topping and suckering; hence the tobacco grown is of inferior quality, and commands but low prices. It is frequently finely cut and sold in the markets at the rate of 7 cents gold per kilogram. It is principally used for a cheap grade of cigarettes.

Cacao (the variety known as Forastero) is grown extensively. Only a few trees are grown about each house, but the total product assumes considerable proportions. Along the road leading from Bauang to the barrio Balagbag the total number of trees amounts to thousands. The product is almost entirely consumed in the province.

Rice of the upland variety was formerly grown to a considerable extent; but at present, owing to the scarcity of carabaos, only limited quantities are grown. Much garden produce is grown also in small patches about the houses of the natives. In the sloping lands surrounding Laguna de Bombon, advantage is taken of the increased rainfall and greater humidity of the atmosphere, and abaca or Manila hemp is extensively grown. When these lands were visited (January, 1903), the entire region was suffering from protracted periods of drought, and the fields of abaca did not present a thriving appearance. The entire output from this region is utilized for the manufacture of native goods, so that considerable care is employed in extracting the fiber to get out only the finest and whitest products of the plant. On the same lands extensive plantings of cocoanut trees have been made, but no flattering results can be expected; for, on account of the distance from salt water and the uneven character of the surface, the lands are not adapted to cocoanut cultivation.

While formerly the greater part of the land of this soil formation was under a fair state of cultivation, the ravages of war were particularly severe, consequently, much land has been abandoned and thousands of hectares are now lying idle, growing up in coarse cogon grass. Along the ravines are found great clumps of bamboo, and the appearance of much of the country is desolate in the extreme. On the more exposed hills, where the soil is very shallow, the bush *Prosopis juliflora* grows in abundance and adds to the appearance of desolation.

Lipa loam.—The name Lipa is a Tagalo word used for a certain kind of tree which it is supposed formerly grew in abundance about the present town of Lipa. The term Lipa loam was chosen for the large tracts of fertile loamy soils found about the town. The soil, to a depth of 25 centimeters, consists of a dark brown, rich looking loam that is mellow, easy to stir and cultivate, and gives evidence of lasting fertility. The subsoil is much darker in color, loamy in texture, but becoming more heavy and waxy at a depth of 75 centimeters from the surface. The total depth of soil and subsoil generally exceeds 1 meter. The broad, slightly rolling areas of this formation readily adapt it to extensive cultivation of large fields. Situated as it is, at a considerable elevation above sea level, the climate is cool and salubrious, and the rainfall greater than in the lower plains to the southward. The largest areas of the formation extend to the north of Lipa, but a small area occurs, bordering Laguna de Bombon to the west of Cuenca. The surface of the country is generally level, or only slightly rolling, for the drainage channels have not had sufficient time to carve deep gorges, as in so much of the country to the southward.

This soil is likewise residual and represents the decomposition products of the underlying volcanic tuffs. On account of the uniform character of the underlying strata of rocks and the generally level surface, the rocks are deeply weathered. So slight is the washing action of the heavy rains that even after a long period of cultivation the fields have not been deprived of their covering of loamy soils that give them their value for agricultural purposes. The Lipa loams comprise the best farming lands of the entire upland portion of the province. They are well adapted to the production of corn, coffee, and sugar cane. Cotton would also prove a paying crop, for there is every reason to believe that, with proper cultivation, good yields of a fair grade of cotton can be grown. At present sugar cane is the principal crop, and large fields can be seen to the northeast of Lipa. Corn makes a good growth and is also one of the leading crops of this section of the province. The rich, loamy character of the soil makes it suitable for this crop, and good yields can be harvested. Tobacco, although nowhere in the province extensively cultivated, would be found a good money crop on this soil, with attention to the cultivation and selection of those varieties suited to the climatic conditions prevailing about Lipa. Cacao is grown only in limited quantities, and the climate is not especially adapted to a large extension of the industry. Rice is largely grown, but of the upland variety, and water is not available for irrigating extensive tracts of land. Some abaca is grown, but in small patches and only for use in the native looms for fabrics. Coffee was formerly one of the leading crops and contributed greatly to the wealth of the neighborhood, but fungus diseases and insects destroyed the old plantations, and little or no attempt has been made to revive the industry. Coffee of the hardy Liberian variety could, in the opinion of the writer, be profitably introduced, in spite of the present low prices. In the old histories of the province, mention is made of the former cultivation of wheat, but it is to be doubted if any large plantings of this crop were practiced. Oranges and other fruits thrive well and find a ready sale in the local markets, as well as in Manila, to which they are exported in considerable quantities.

Prior to the insurrection, the area covered by this soil was one of the most flourishing agricultural districts in the whole archipelago. The ravages of war were particularly severe, but in a short time the district should be in a good condition—so favorable are the soil conditions for agricultural advancement and prosperity.

Taysan clay.—In the eastern part of the area, occupying many square kilometers, occurs a large body of land with uniformly similar soils, that has been named Taysan clay. Large typical areas of this soil are found about the towns of Taysan and Rosario, and stretching to the eastward far beyond the limits of the present survey. The surface soil, to an average depth of 16 centimeters, consists of a heavy black clay that is tough and tenacious, with a tendency to bake hard, forming great cracks in the surface. The subsoil usually consists of the same material, tough, black clay, to an average depth of 35 centimeters from the surface. In places the subsoil is much lighter in color, but of the same character and texture and, from its impervious nature, does not allow the free passage of water through it. In some of the more level areas of this formation, the total depth of soil and subsoil exceeds 1 meter. Again, the underlying rocks may be found 20 centimeters from the surface. The surface of the country lies from 100 to 200 meters above sea level, and in general is level or only gently rolling. To the north of Rosario, it gradually merges into the Lipa loams; to the south it likewise merges into the Talumpoc clay loams; while on the west the same gradation into the brown Ibaan clay loams is noticed. The line of contact with all of these soils is not sharply defined, but a gradual transition from the one type to the other. The continuity of the formation is broken by Mount Tumbol and the small mountain south of Lipa. It is only in the large area of Taysan clay, east of the town of New Rosario, that the drainage channels are not well established. The small streams wander about over the surface and even in the protracted seasons of drought there is a slight tendency to swampy conditions, so that in the rainy season large areas are covered with water that slowly drains away.

The origin of this type of soil is similar to that of the two preceding ones. It represents the decayed underlying strata of soft tuffs and scoriaceous sediments that have been deposited in water by the Taal Volcano, or some of the numerous volcanic vents that form so characteristic a feature of this portion of Luzon. The black color and almost mucky condition of the soils in some of the area is undoubtedly due to the poor drainage conditions and the decay of the rank growth of grass during long periods of years.

Coffee, even at the present time, is the principal crop and, although the plantations are poorly cared for, the product forms one of the leading money crops of the area. The large groves of decaying Madre Cacao trees tell of the former existence of extensive coffee fields.

For a long time the coffee industry was one of great importance to this district, for the product brought good prices in the Manila markets and compared favorably with the better grades of coffee grown in various parts of the world. Fungus and insect pests wrought great havoc to the bushes and, in a few years, the industry had dwindled to almost nothing. At present the few remaining groves are in a state of sad neglect, but crops are sold at a fair rate of profit in the local markets.

Some corn is grown on the drier, better drained soils. Sugar cane, while never extensively cultivated in this section, is also grown to some extent, but with only indifferent results.

In the eastern part of the area many fine bodies of land are seen that are admirably adapted to grazing purposes. The surface is thickly covered with a thick mat of rich succulent grama grass, that would furnish pasturage to large herds of cattle and horses. Little use is made of this land for this purpose, and large tracts of land are lying idle, not utilized for any purpose whatever. From the impervious nature of the subsoils, much of this open grazing country could be made the center of a large rice industry. The small streams would furnish an adequate water supply for considerable tracts of land at a nominal expense, while, for the further extension of such an industry, there is no doubt that an abundant supply of irrigating water could be reached by means of wells. As yet, there has been no attempt to get artesian wells but, from the nature of the underlying rock strata and the high range of mountains to the northward, a good supply of water should be reached at no inconsiderable depth.

Malabo waxy clay.—In the area surveyed are two small areas of soil that possess striking characteristics, that has been called Malabo waxy clay. As the name implies, the soil, to a depth of 45 centimeters, consists of rich, black, waxy clay. The percentage of clay is very high and this, with its peculiar waxy character, readily serves to distinguish this type of soil from the others just described. Little difference is observed between the soil and subsoil, except that the latter sometimes grades into a soft, yellowish clay, at considerable depth. Under the subsoil is found broken and partially decomposed limestone. The greater area of this soil is situated 15 kilometers directly east of Batangas, while the other area lies 7 kilometers southeast of the same city. The first area comprises the limits of a small mountain that lies southeast of the barrio Malabo. This small rounded mountain attains an elevation of 350 meters above sea level, and is symmetrical in outline. The smaller area is likewise situated in a rough, broken region, that forms the foothills of the Loboo mountains. The elevation of this smaller area does not exceed 300 meters above sea level. Both areas, on account of the rolling mountainous character of the topography, are well drained, while their elevation insures a cooler climate and greater humidity and rainfall than in lower plains.

Like the preceding soils, the Malabo waxy clay is residual, but has been derived from a totally different class of rocks. The rocks from which this soil has been derived are hard, crystalline limestones or marbles, composed largely of carbonate of lime and a slight amount of fine sediment. The rains tend to dissolve this easily-soluble rock, so that the soils consist principally of the fine sediment and impurities that composed the original rock. Soils derived in this manner from pure limestones are generally rich and fertile, and the soils of this formation certainly form no exception to the rule. The rank, luxurious growth of bushes and weeds at once denotes the great fertility of these soils. While difficult to plow and work, even with scant cultivation they yield good returns of the few crops cultivated. Only the lower slopes are cultivated, but good crops of corn are harvested, and all kinds of vegetables yield well, while bananas and other fruits make a wonderful growth. These soils are of lasting fertility and readily repay the extra cost necessary to thoroughly prepare them before planting. The limited extent of the areas occupied by this formation, and the lack of suitable transportation facilities, are the only obstacles in the way of making them important agricultural districts.

Macolod gravelly loam.—This formation occurs, typically developed, on Macolod Mountain, as well as on some of the smaller peaks. The soil is similar in many respects to the Ibaan clay loam. It consists, to an average depth of 15 centimeters, of a brown, tenacious clay loam, that contains from 10 to 20 per cent of fine rounded gravel, about 5 millimeters in diameter. In some of the localities where this soil formation occurs, as on Mount Macolod, there is a slight admixture of sharp, angular gravel, composed of the hard, black volcanic rock known as andesite. On the upper slopes of the mountain, many bare rock surfaces are exposed, and the steep character of the slopes prevents any attempt at cultivation. On the foothills of the Malarayat range of mountains, soils of a similar nature are found; but on some of the slopes occur somewhat sandy loams, while on the higher, steeper slopes the soil covering is thin, and frequently wanting altogether.

These soils are all derived, by the process of slow decomposition, from the underlying rocks and, from the nature of the slopes, no great accumulation of soils can take place.

Cultivation of these soils is nowhere extensive. On the lower slopes of Mount Macolod some abaca is grown and, when a favorable site is chosen, fair results are obtained. On Malarayat Mountain, the conditions seem better adapted to the growth of abaca and some fields of this crop, as well as corn, coffee, and tobacco fields, in a flourishing condition were seen. On Mount Vigain, Tumbol, and other isolated areas of this soil, no cultivation is practiced and, except for pasturing a few horses and cattle, no use is made of the land. On Macolod and Malarayat small patches of the original forest growth remain, but no attempt is made at the present to utilize the timber.

The shallow character of the soils and the steep slopes are against any considerable development of these lands. Some small areas occur where fields of abaca, corn, and tobacco can be raised, but the greater part of the land is not well adapted to farming purposes.

Talumpoc clay loam.—In the southeastern part of the area occur large tracts of land with similar soils, called Talumpoc clay loam. The soil to an average depth of 10 centimeters consists of a hard, compact black clay loam. In places the depth of soil does not exceed 5 centimeters, while in others it is 18 or 20 centimeters in depth. The depth of soil depends largely on the character of the surface, although frequently on the more level slopes the covering of soil is quite shallow. Under the soil occur the hard, granular volcanic tuffs and other rocks from which the soils are derived. The area occupied by this formation is rough and mountainous, and the higher peaks attain an elevation of more than 700 meters above sea level. Sharp, angular, and rounded peaks characterize the region, with deep, narrow valleys. The small streams are turbulent, flowing over beds filled with huge bowlders. Earthquake shocks are numerous in the region, and one locality was observed where an area of more than 1 square kilometer had subsided, leaving great bare rock walls exposed many meters in height, while the ground was strewn with great angular bowlders that bore evidence of the great convulsions of the earth that had taken place. This locality lies just west of the barrio Santo Niño, about 8 kilometers south of Batangas. On the higher, sharper peaks the soil covering is frequently wanting, and great bowlders and rock walls are common.

The rocks which, through weathering, have formed the shallow soils are all volcanic in origin, and consist of hard, compact granular tuffs and solid red and black andesites. The slow rate of decomposition of such rocks renders impossible any considerable accumulation of soil on the steep slopes.

The entire region is sparsely peopled and the cultivation of the soil limited. Small crops of corn and garden produce are grown around the few houses, while the customary number of banana plants and orange and cacao trees are always seen. The greater part of the area is cleared, and showers of almost daily occurrence give the region a fresh, green appearance that is not seen in the lower plains during the dry seasons. Except for grazing purposes, for which the region is well adapted on account of the cool, moist climate, the land has at present little agricultural value.

Calumpang loam.—In the low plains bordering Batangas Bay and along the Calumpang River are found many areas of varying size of Calumpang loam. The soil is a heavy, dark-colored loam to a depth of 20 centimeters. Underlying this is found black, waxy, heavy loam that, at a depth of 60 centimeters, grades into stiff, sandy loam of a yellowish color. The soil is stiff and, with the present method of plowing, when the land is wet, bakes badly, forming great masses of large clods that can only be broken with considerable difficulty. The main areas of this type of soil are just east and south of Batangas. Smaller areas are situated west of Batangas, while the city itself is located on this character of soil. The surface is quite level and forms wide terraces, situated but a few meters above sea level. The area is quite well drained, but the value of some few localities would be greatly enhanced by open or underground drainage. The origin of this soil is very different from the preceding ones. It represents the accumulations of fine sediment brought down by larger streams of the area and deposited in shallow water, in the manner in which large streams build up their flood plains. The level, terraced nature of much of the area undoubtedly proves that it has been formed by the slow accumulation of material during times of excessive rainfall. Soils that have been formed in this manner are, with few exceptions, fertile, and such is the case with this soil. It consists of the finer particles of soils carried long distances by the streams, and nearly always contains a good proportion of thoroughly decomposed vegetable remains that further increase the fertility of such soils. The principal crop on this soil for many scores of years has been sugar cane. The soil is well adapted to this crop, and prior to the insurrection almost the entire area was cultivated in sugar cane. At present some large fields of this crop are seen, but much of the land is lying idle. The methods of grinding the cane and extracting the sugar are primitive in the extreme. No mills were seen that used steam power for grinding, while sugar making is accomplished by the open-kettle system methods in common use half a century ago. It necessarily follows that the manufactured product is of inferior quality and can not command a high market price. Corn is grown on a small scale, and during years of protracted drought the yield is slight, but in more favorable years a good return is made for the planter. Little or no rice is grown, but the nature of this soil adapts it nicely to this crop, and more profit could be made by growing this crop than by cultivating cane, with the present low prices. East of Batangas the manufacture of ollas or earthenware vessels provides employment for a large number of people. The waxy subsoil is dug up and kneaded to the proper consistency, when it is molded by means of a wheel into the desired shape and fired by surrounding the pile of freshly molded jars and pots with dry pieces of bamboo. The entire work of preparing the earth, molding, and firing is done within a period of a day. These pots and jars are carried on ponies in large baskets, or by the natives themselves, to all parts of the province.

Calumpang silt loam.—In the area surveyed are three small areas of Calumpang silt loam. The largest of these areas lies just west of Batangas, while the other areas are not more than 2 kilometers distant from the city—one southeast; the other northwest. The area of the three areas does not exceed 1 square kilometer. The soil, on account of the large proportion of silt it contains, bakes badly and forms firm clods that frequently have a glazed appearance. The soil differs from that of the Calumpang loam in being more compact; consequently, it is more difficult to cultivate. The depth of grayish brown silt loam averages 20 centimeters. The subsoil is much more loamy in texture than that of the preceding soil. It possesses only to a slight extent the waxy character of the Calumpang loams. The subsoil is dark in color and much more easily drained than the subsoil of the Calumpang loam. On account of the more tenacious character of the soil, this soil type does not form as desirable a class of farming land as the Calumpang loam. The areas of this soil lie within the limits of the coastal plain. The surface is quite level and elevated not more than 10 meters above mean tide level. The soil has been formed by the slow washing of the finer material into shallow waters, that have since subsided, leaving the deposit exposed. The area southeast of Batangas is, however, part of the flood plain built up by the small stream along which it occurs. This soil is also rich and fertile and well adapted to the growth of sugar cane and corn, but more labor is necessary to prepare the land than the preceding soil type; but, with proper cultivation, the yields of both of these crops would be nearly as large. On the area just west of Batangas rice is grown, for which purpose, on account of the low position it occupies, it is well adapted. Zacate also forms a valuable crop on this area, by reason of the nearness to the city and the large demand for such feed, especially during the dry months.

Calumpang sandy loam.—Four areas of this soil type were found in the low country bordering Batangas Bay, the most important of which lies just south of Batangas, bordering on both sides of Calumpang River. The soil, to a depth of 25 centimeters, consists of a rich, mellow, sandy loam. Under this covering of brown fertile soil occur fine sands and sandy loams to a depth of more than 1 meter. This soil, on account of the percentage of sand it contains, forms for many purposes the most desirable soil of the entire province. Porous, well-drained, it can be cultivated when the more heavy soils are flooded with water; and, on the other hand, due to its situation and nearness to the bay, it contains a good supply of moisture long after the heavier soils have become baked hard and dry.

The surface is level, in common with the other soils of the coastal plain. The greater part of the area represents the present flood plain of the Calumpang River and, during periods of extreme high water, is liable to be overflowed. But such freshets do not occur oftener than once in every few years. The soil represents the coarser material brought down by the river in times of high water and deposited near the banks of the river.

The sandy mellow character of these soils makes them especially adapted to the production of all kinds of garden vegetables, and some of the land is used for this purpose. The cultivation of radishes is carried on on a large scale, and the abundant crops find a ready sale in the local markets. Sugar cane is largely grown and good crops are harvested, while corn does perhaps better than on any of the previously mentioned soils. On account of the nearness to Batangas, these lands command a high price and, for the production of the many crops adapted to such soils, they justly deserve it.

Muck.—Bordering Batangas Bay, or situated but a short distance from it, is a long, narrow area of muck. The surface of the land is very level and nowhere attains an elevation of more than 5 meters above sea level. The soil consists of black silt and clay to a depth of more than 1 meter. The low position the area occupies accounts for the presence of standing water within a few centimeters from the surface, even during the dry season. In the rainy season the surface is generally covered with water. The saturated condition of these areas of muck renders the soil unfit for cultivation, except for certain special crops. The greater part of the land is diked and largely used for rice, which succeeds admirably on soils of this character. The cultivation of zacate is extensively carried on and proves a paying crop, on account of the large demand in Batangas and Bauang. Several crops are annually harvested from the same field, and in the city of Batangas can be seen daily the vendors of fresh green grass cut from these fields. Some attempt is made to cultivate these fields, but the heavy wet soils break into large masses that soon bake into hard clods that furnish scant nourishment to growing crops. During the dry season, when the surrounding country is burned and parched, the appearance of the fresh green zacate fields is specially pleasing.

Salt marsh.—Bordering the bay and extending in some cases as far inland as 2 kilometers are three areas of salt marsh. These lands are low and flat and situated but a slight distance above tide level. Small tidal streams ramify through the areas and furnish the necessary salt water for the extensive operations in salt making that are carried on. The land is laid off into a number of small farms that are utilized for the manufacture of salt by the evaporation of sea water. Much of this land lies sufficiently high above the tidal streams to be utilized for cultivation, but salt making has been carried on for many scores of years, and it is doubtful if other uses will be made of the land for many years to come. The soil is generally sandy and if washed free from the large amount of salt it contains could be classed with the Calumpang sandy loams. The total area of salt marsh does not exceed 5 square kilometers.

AGRICULTURAL CONDITIONS.

Batangas Province was one of the first twenty political divisions into which the island of Luzon was divided by the Spaniards shortly after their arrival in the islands. Prior to this time, about the middle of the sixteenth century, it was known as the lands of Kumintang, on account of the sorrowful song which the natives generally sang. Situated close to Manila it was early brought under the control of the Spaniards and every inducement offered to agricultural advancement and prosperity, so that it soon gained an enviable position among the various provinces. As early as 1680 Lipa and Batangas were towns of several thousand inhabitants each. In the early histories mention is made of the cultivation of wheat, rice, coffee, indigo, corn, cotton, pepper, cacao, and all kinds of fruits and vegetables. Mention is also made of the abundant pasture lands and luxurious vegetation, while the soils are spoken of as being rich and fertile. From this early date the position of the province was an important one, and it continued to increase in wealth and prominence until the last few years. The cultivation of sugar, and especially coffee, and the raising of fine cattle and horses were the factors that gave distinction to the province. Mention has been made, in connection with the description of the Lipa loam and Taysan clay, of the destruction of the coffee industry. Before the destruction of the plantations by the insect belonging to the genus *Xylotrechus* and the fungus of the genus *Hemileia* large quantities of coffee were annually exported, and for quantity as well as quality Batangas coffee ranked foremost among the coffee grown in the islands. The destruction of this industry was a severe blow to the province, while low prices for the last few years have destroyed the profits of sugar raising in the Philippines. The primitive methods employed in sugar making and the lack of care in cultivating the growing cane operate against getting large returns from the land, but formerly sugar cane was one of the principal crops. In nearly all of the area surveyed the remains of old sugar mills can be seen, but the present area under cultivation is restricted to those soils that are most favorable to this crop.

The province at the present time is in very poor condition; for, in addition to the decline of the sugar and coffee industries, the country was greatly devastated during the last insurrection. Thousands of native houses were burned, the crops destroyed, and cattle, horses, and carabaos were killed in great numbers. The sites of former flourishing barrios are now marked by a thick tangle of weeds and underbrush, while occasional burned and blackened poles mark the location of the former houses. Thousands of hectares of land that a few years ago were under cultivation are now covered by waving fields of coarse cogon grass, and numerous ditches and trenches, half concealed by the long grass, tell of sharp fighting not many months since. One serious disadvantage in placing the province on its former footing is the lack of suitable beasts of burden, which suffered greatly during the last few months by the ravages of rinderpest. Batangas, in common with most of the provinces, lost many thousands of horses and carabaos. From this wholesale devastation of houses, fields, and live stock, it will necessarily require considerable time to fully recuperate; but already the work of improvement has begun, fields are being cultivated, and houses are being constructed, while the provincial government is furnishing employment to large numbers of natives in building good roads to those towns not already so provided.

Most of the land is controlled by large owners, who lease it to the poor natives. In the more mountainous regions of the area much of the land is still owned by the government. About many of the towns the church owns fine tracts of farming land. Native labor is employed for cultivating the land, and the common price paid is 2 pesetas ($0.15 United States currency) per day. The natives are all Tagalos, one of the original Malayan types of people that has been considerably modified by frequent crossing with other races, especially the Chinese. Farming is carried on in the most primitive manner. Plowing is accomplished by means of a rude plow drawn by a carabao, slow and sluggish in its movements, but strong and well suited to the conditions in many districts. The soil is seldom stirred below a depth of 12 centimeters, while the common practice of plowing where the soils are wet or under water tends to puddle them and form great masses of clods, which can not be thoroughly pulverized by the harrows in common use. Often these harrows are made by lashing a few pieces of bamboo together, while the projecting twigs serve as teeth to scratch the soil. Little or no fertilizers are used, even on the small patches adjoining the laborers' houses.

In addition to the sugar and coffee industries that have been mentioned, many other crops are cultivated that deserve mention. Corn is extensively grown in all parts of the area, and in favorable years the yield is good. The ears are plucked from the stock and strung alongside the house, or on large frames which are specially constructed for drying and storing the crop. Cotton is grown as a perennial, and the plants are continually blossoming and the crop maturing. Small patches were noticed, but the crop is grown with indifferent results. On the more elevated lands, as about Lipa, there is every indication that cotton culture can be successfully carried on with good results. Proper care and cultivation are necessary to insure the success of the crop. Around the native houses are usually found a few cacao trees, which furnish a sufficient supply of chocolate for local consumption. The success attained by these trees would seem to favor a large extension of the industry, although the climate conditions are not so favorable to cacao in Batangas Province as other parts of the archipelago, where the rainfall is more equally distributed over the entire year.

Rice is largely grown at the present time, but the production does not equal that of a few years ago, when the cultivation of the crop was quite extensive. Except on certain areas, where water supply is available, rice will never be the leading crop in Batangas Province, as the surface features and elevation of the area better adapt it to crops other than rice. On the lowlands adjoining Batangas Bay the area devoted to growing rice can be increased, while about Rosario the writer believes conditions favor the establishment of a large rice industry. Upland rice can be grown in many localities; but, as the quality does not compare with the lowland or irrigated rice, no great extension of upland rice cultivation can be expected.

The abundant areas of pasture land afford pasturage for live stock, and for a long time Batangas ponies have brought good prices in Manila markets. Many fine cattle are to be seen in the province, that excel those of many other districts in the islands. Vegetables are grown to a considerable extent. On the road between Batangas and Bauang much care is taken, and the soil thoroughly cultivated and irrigated, so that the quality of the garden produce probably excels that of other parts of the province. Oranges, bananas, mangoes, and other fruit receive considerable attention, and yield a fair return to the planters. Tobacco raising should be encouraged, for many localities exist that will, with care and attention, produce a good quality of leaf, suited to cigars and cigarettes. On the level or rolling fields about Lipa the loamy soils are excellent lands for many crops, and will bring good returns to the intelligent planter. They are especially adapted to corn, sugar cane, cotton, tobacco, fruits, coffee, and vegetables. Almost every hectare of the Lipa loams which are found in this locality will, with proper attention, pay for its cultivation in any of the crops just mentioned. In the case of the Ibaan clay loams, occupying such large areas about Ibaan, San José, and north of Bauang and Batangas, the case is different; the soils are more shallow and of such a tenacious nature that cultivation is more difficult and the returns less. On the level areas, where some depth of soil overlies the rocks, advancement can be made, and in such areas sugar cane, corn, and tobacco can be grown with profit; but thorough cultivation and fertilizers are necessary to build up much of the land depleted by scores of years of hard farming. The problems of the planter are more difficult and the returns correspondingly less on these soils than on the Lipa loam. About Rosario and Taysan the soil conditions of the Taysan clay are favorable to coffee culture and fruits, the cultivation of rice, and the pasturing of large herds of live stock.

Along the Calumpang River, near Batangas, the areas of loam and sandy loam soils are favorable to growing sugar cane and corn. These soils are rich, and in spite of the high price of the land, will bring fair profits to the careful planter. The problem of the mountainous soils is difficult; the soils are generally thin and poor, and not well adapted to cultivated crops. Many fine stretches of land can be found, however, that are evidently suited to grazing purposes.

Batangas Province stands well at the head of the list for the many fine roads it contains, that are in good condition, even during the height of the rainy season. A fine military road leads from the Playa near Batangas, through San José and Lipa to Calamba. This road is at all times in good condition, and furnishes means of communication from the central portion of the province to water transportation on Laguna de Bay or Batangas Bay, where daily boats leave for Manila or other ports. From Batangas also a fine road leads to Bawang, and on to Taal. Many roads in fair condition during the greater part of the year connect many of the pueblos and barrios. Generally speaking, the roads of the province are numerous and in good condition during many months of the year. Batangas and Bauang are both situated near the Bay of Batangas, and at the former place frequent boats to Manila and other points in the islands afford cheap transportation for those products that are exported from the province. The only water transportation in the interior of the province is the Calumpang River. Large rafts are constructed of bamboo, and hauled up and down the river by carabao for a distance of many kilometers above Batangas. Little use is made of Laguna de Bombón for transportation purposes, although a recent rumor states that the river leading from it to Balayang Bay will be deepened, making it navigable for small steamboats and lorchas. This will enable products from much of the northern part of the province to be shipped more cheaply to Manila than formerly.

Batangas and Lipa, as well as the smaller towns, maintain large markets, that provide a ready sale of much of the minor produce of the province, while the nearness to Manila and cheap transportation are advantages of some consequence.

BUREAU OF AGRICULTURE.

(Bulletin No. 6.)

SOIL FERTILITY.

By W. C. Welborn, chief of bureau, 1905.

MANURES AND COMMERCIAL FERTILIZERS.

All plants are made up of substances taken from the earth and the air. The roots of plants absorb water from the moist soil, and with it some of the solid parts of the earth dissolved in the water. When a plant is burned, the ash remaining is composed mainly of what came from the earth during the growth of the plant.

Plants, after becoming dry, have generally from 1 to 10 per cent of ash. The other 90 to 99 parts were derived from the air. Practically half the weight of dry plants is derived directly from the air through the medium of the leaves. All plant leaves absorb carbonic-acid gas—the gas that is used to charge mineral waters. This gas is easily produced by pouring strong acid on limestone. It is produced in nature on a vast scale by the burning and rotting of wood and other vegetable substances. It is also given off from the lungs of animals. When the leaves of plants absorb carbonic-acid gas from the air, the plants use the carbon (converting it into solid tissue), and give off oxygen gas, pure as originally. Oxygen for breathing is necessary to the life of man and animals. It is thus seen that animals and plants are dependent upon each other for the breath of life.

This mutual dependence does not stop here. Animals must have certain salts which help to make up the solid parts of the earth, in order to live and grow. But man and animals can not digest stone or earth. These earthy salts must be taken into plants and be combined there into substances digestible and nourishing to animals.

Then, the manure of animals is a good food for plants. When animals die their bodies also add fertility to the earth.

That a farmer can not enrich the air with plant food so as to benefit his crops is readily seen. This has been done successfully only in greenhouses, where the air can be controlled. All efforts in this direction must be mainly confined to adding plant food to the soil or to improving the condition of the soil so that its own large stores of plant food may be more easily taken up by plants.

We may improve land chemically by adding to it manure, ground bone, nitrate of soda, or other rich substances; or we may improve it mechanically or physically, by draining, plowing, etc. Very often, and it may be said generally, both kinds of improvement follow each operation. If manure is put upon land, it not only adds plant food to the soil but also loosens it, makes it drain better, and enables it to hold moisture better in time of drought. By rendering the soil more open and porous, the air can enter it more freely, causing many beneficial chemical changes to occur. Again, it is very well known now that many germs or bacteria (probably about the size of those that give us disease, but altogether friendly) feed on manures and other vegetable substances in the soil and perform many functions very necessary to make land highly productive.

New or freshly cleared land is generally productive, partly due to the large quantities of rotting leaves, stems, and roots of plants, and remains of dead insects contained. These keep it in good mechanical condition, so the air can enter and act chemically on the solid rock particles of the soil and make the plant-food elements soluble in water, so they can be used by plants. Then, as these organic remains of plants and animals decay completely, they furnish food directly to new plants. It may thus be seen that if enough weeds, grass, and coarse manures, etc., are plowed under, old and worn land may be made fresh and fertile again.

Land in the Tropics appears to change in fertility very rapidly, or it wears out quickly. In a cold climate, where the ground is frozen for six or eight months in the year, the humus, or decaying vegetable remains referred to above, lasts for a great number of years. This humus is generally absolutely necessary to keep land productive; and in the Tropics, where rotting goes on all the time, the supply of humus becomes rapidly exhausted under constant cultivation. It is true that when the land ceases to be cultivated an enormous growth of weeds and grass, and often tropical jungle, comes and soon restores a large amount of rotting vegetable matter. Hence it is that in many tropical countries land is cleared and cultivated for from one to three years, and allowed to run wild six or eight.

Unless labor is very abundant and cheap, it will generally be found cheaper to keep up the fertility of the cleared land by growing restorative or fertilizing crops and using manures and fertilizers.

All plants, as well as the crops we grow, are composed of about ten necessary chemical elements. Elements may be roughly defined as the "a b c" of matter. All matter is made up of combinations of elements. The scientists are continually discovering new elements, and they probably have a hundred by this time. Of the ten found necessary in plants, only three ever become scarce enough to necessitate their being added to the soils we cultivate. These three are nitrogen, phosphorus, and potassium.

Nitrogen comprises four-fifths of the air, but in this condition it is worth nothing to plants. They get carbon through their leaves, but they can not take nitrogen in this way. It must be found in some solid or liquid form in combination with other substances, as in animal manure, nitrate of soda, oil cakes, or in the stores of nitrogen compounds in the soil. Nitrogen is also one of the most necessary elements of food for men and animals, but we can not appropriate to our needs what we breathe. We must get it in lean meat, eggs, milk, beans, pease, and in lesser quantities in most other foods.

Nitrogen is the soil element likely to become soonest exhausted and the costliest one when we come to purchase it as a fertilizer. It will become exhausted more rapidly in a tropical country than in a temperate one. In the States nitrogen in fertilizers is rated at from 15 to 16 cents gold a pound. Here, no doubt, 20 cents would be a low price, if the fertilizer materials must be shipped from the States. While much more costly, pound for pound, than the other elements required for use in fertilizers, nitrogen does not generally have to be used in as large quantities as phosphoric acid.

Phosphorus, the fertilizer element generally required in largest quantity, is never found pure in nature. It is nearly always spoken of in agricultural and chemical works as phosphoric acid, and in this form is worth in America about 5 cents United States currency a pound. It is seldom utilized by plants in as large amounts as are potash and nitrogen, but it is scarcer and less available in soils, and hence experience has proved that in using fertilizers more phosphoric acid should generally be used than either of the other ingredients.

Nor is potassium ever found pure in nature, but it is quite well known as potash, which is a compound of the metal potassium with the oxygen of the air. So we speak of potash when discussing the valuable ingredients of fertilizers. Its value in fertilizer materials is generally about 5 cents, United States currency a pound.

Just what functions each of these ingredients performs in the development of the plant is not fully known. It is very well known that no plant could live if either one were lacking, nor, for that matter, in the entire absence of either of seven others found in plants.

Nitrogen in abundance is known to make plants grow vigorously and produce large, dark green leaves. Phosphoric acid is known to be favorable to the production of seeds and to favor early maturity of plants. Potash is known to be essential as a carrier of starch from one part of a plant to another and to fulfill other necessary offices in the plant economy.

A large source of nitrogen in nature is the nitrate of soda, or Chile saltpeter. This material contains 16 per cent of nitrogen, or 320 pounds per ton. Nitrate of soda has no other ingredient of any value as fertilizer. So if nitrogen is worth 20 cents a pound in Manila a ton of nitrate of soda will be worth $64 United States currency.

Sulphate of ammonia is another source of nitrogen, and contains 20 per cent of this ingredient, or 400 pounds per ton. This, at 20 cents a pound, will make its value as a fertilizer $80 gold. Sulphate of ammonia is a by-product in the production of coal gas, coke, etc.

Cotton-seed meal contains about 7 per cent nitrogen and cocoanut cake about 3 per cent. These are therefore valuable as fertilizers, not only for their nitrogen but for their phosphoric acid and potash as well.

Dried blood, meat scrap, fish refuse, wool and leather wastes, and many other materials afford valuable sources of nitrogen for fertilizers.

Animal bone is rich in phosphoric acid. The phosphate rock, which is composed of the bones of prehistoric animals, is the largest source of this ingredient. The phosphate slag from the Bessemer steel works is also a valuable source of phosphoric acid. The phosphate rock, which is mined in many parts of the world, must be ground and mixed with sulphuric acid to make its phosphoric acid soluble and available to plants. This combination makes the acid phosphate or superphosphate of commerce, and is by far the commonest form in which phosphoric acid is used as a fertilizer. A rich rock will produce an acid phosphate containing about 16 per cent of available phosphoric acid. There will also be a small percentage of phosphoric acid not available; because, if but slightly more sulphuric acid be used than just enough to combine with all the rock phosphate, a sticky mass will result that can not be handled. The phosphoric acid remaining unavailable to plants is considered as of very little value or none at all.

A good acid phosphate, then, will contain about 320 pounds of phosphoric acid to the ton. If worth 5 cents a pound in the United States it will probably be worth 7 cents here, or $22.40 a ton. There is nothing else in the acid phosphate that is counted as having any value. About half of its weight is lime, to be sure, and this is no doubt beneficial to some crops and some soils.

Potash is generally abundant in the ashes of plants, and these are often used for fertilizing purposes. Muriate of potash contains 50 per cent of potash, and at 7 cents a pound here for the potash would be worth about $70 a ton.[a] This salt, containing chlorine, injures the burning qualities of tobacco when used to fertilize this crop, and is otherwise injurious to many crops. Sulphate of potash is a better form in which to buy it. This contains 50 per cent potash, and hence may be said to have a value of about $70 to $75 United States currency per ton.

It has generally been found the world over that fertilizers containing all three of the ingredients above discussed in suitable proportions are more profitable than those containing one or two of them. There are notable exceptions to this general rule which will be discussed later. These islands being so far away from the sources of most of these materials, only the best grades should be shipped here, so as to effect a saving in freights and other charges.

There is still a great deal to be learned about the fertilizer requirements of soils and crops. It was once believed that an analysis of a crop would show its needs for fertilizers, the ingredients and the proportions in which these should be given. This idea is now known to be erroneous; yet assertions as to crop requirements based, it is believed, on no better evidence seem to be generally made and accepted to-day. For instance, it is almost universally claimed in agricultural literature that fruit and garden crops need much larger proportions of potash than cotton or grain crops. The potato is always credited with needing more of potash than of any other ingredient, yet late results of experiments indicate that potash is of much less importance than either nitrogen or phosphoric acid in the growth of the potato. The writer does not believe that the experimental evidence at all warrants the very common claim that fruit and truck crops generally need larger relative amounts of potash than other crops. In fact, the results of experiments have generally tended to minimize the usefulness of large amounts of potash as compared with the other two valuable ingredients.

There is a large class of crops not requiring nitrogen to be applied in fertilizers. These crops are the leguminosæ of the botanist, such as beans, pease, peanuts, clovers, and other pod-bearing plants. If one of these plants be dug up and the roots carefully washed, a great number of little wartlike growths will be seen on the roots. These tubercles are the abode of millions of bacteria, themselves minute living plants, that have the power of combining the nitrogen of the air and putting it in shape to be fed to the host plant. In this way a cowpea crop on an acre of land has frequently been known to get from the air 100 pounds of nitrogen. This quantity of nitrogen in fertilizers would be worth $20. Occasionally large velvet bean and peanut crops have been known to contain 200 pounds of nitrogen per acre. Of course, if these crops are allowed to rot on the land or are plowed under, these large amounts of nitrogen become food for other crops, and hence the legumes are generally called restorative or land-improving crops. If animals eat these crops, the manure produced will be richer than that made from the consumption of most other foods. Even when pease or beans are made into hay or otherwise gathered and removed from the land, the nitrogen contained in the roots and stubble still benefits the land greatly. It has often been found that where a cowpea crop follows oats or wheat and is cut for hay the crop the following year is benefited as much as it would have been by the application of several hundred pounds of rich fertilizer.

In the more progressive farming sections of the United States the nitrogen-consuming crops, such as corn, small grain, potatoes, cane, tobacco, and cotton, are regularly alternated with pease, beans, or clover. In this way the fertility of the land is kept up, and better and larger crops are secured. Often the restorative crop is fertilized with phosphoric acid and potash. In this way its growth is greatly stimulated; hence the amount of nitrogen gathered from the air is increased and the enriching effects of the legume are greater for the next crop.

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[a] The Strassfurt mines of Germany are the principal source of the world's supply of this ingredient.

It seems a great waste of resources to allow Philippine rice fields to lie idle from December to June. The land grows a crop of tough, coarse grasses. These burn off during the dry season instead of being plowed under, to help keep up the fertility of the land. Then the roots of these grasses are often picked up while plowing for rice and taken off the land. The land grows rice year after year with never a change. No other grain crop known to the writer would continue to yield profitable results under such soil management.

Suppose a piece of rice land should be cleared of its rice in December and promptly planted in Florida velvet beans. These beans will very soon cover the ground with a dense mass of foliage, and all foul grasses and weeds be completely choked out. A quantity of nitrogen will be added to the soil by rice-planting time in June and July and, whether the bean vines are taken off for stock feed or cut up and plowed under, the land will be very much enriched. Moreover, the weeds and grass will be so choked out that the rice will have clean ground in which to grow, and should make a greatly increased yield.

The Bureau of Agriculture succeeded in completely cleaning a piece of land of nut grass by growing velvet beans during the last wet season. Other plantings were made early in the dry season, and the beans have grown fully as well as they did in the wet season. Peanuts might grow on the rice land during the dry season, and make profitable crops, and yet the vines would considerably enrich the land. Cowpeas, mangoes, and other restorative crops would likewise give profitable food or forage crops, and also enrich the land for the regular rice crop; but no other crop will be found so effective in cleaning the land as velvet beans, and this is a very important matter in a tropical country. This crop leaves the land so clean, moist, and porous that very little plowing or other preparation is needed to fit it for starting another crop.

Over 100 acres of the Murcia rice farm have been planted in cowpeas and velvet beans, with the expectation of following with rice in June. On land naturally as thin and poor as this a very material increase in yield should result.

It is clear, then, that land may yield a regular crop every year indefinitely, and, if restorative crops (say velvet beans) are grown regularly in the off seasons, the land will remain as fresh, as productive, and as free from obnoxious grasses as if it were freshly reclaimed from the forest. Since the restorative crop is a profitable food or fodder crop, it will more than pay for the work of growing, and keep up the land fertility besides. This, then, is a very much more profitable practice than letting the land grow up in weeds, grass, and forest for a period of years.

The plan commonly practiced in Luzon, of growing one crop of sugar cane and then letting the land lie idle and grow up in weeds and grass for a year, could be immensely improved upon by the use of a fertilizer and growing one stubble or rattoon crop and then running it in velvet beans for a year. In Negros the land is better and a rattoon crop is generally obtained, but the land is then fallowed or pastured a year or two. In every case where land lies idle, although it materially improves, it is costly and difficult to bring it into cultivation again, while a restorative crop like the velvet bean would enrich it more and be much cheaper to handle.

It may be asked if land growing a nitrogen-gathering crop each year will not soon become exhausted of phosphoric acid and potash. It may be said, generally, that land of good natural fertility, and especially the stiff clay and alluvial lands, if treated annually to a good dose of rich vegetable matter, such as a crop of velvet beans or cowpeas, will have an abundance of phosphoric acid and potash rendered soluble each year. In fact, the velvet-bean plant dried and analyzed would show over 2 per cent of potash—as rich in this ingredient as most commercial fertilizers. Two tons of the dry roots, leaves, and stems of this plant plowed under on an acre would give 80 or 90 pounds of potash in almost as good form for use by future crops as if applied as fertilizer. So, as long as restorative crops make large yields, it is proof enough that other crops following will not suffer for the want of any of the elements. True there are large sections of sandy land too poor to yield large restorative crops unless fertilized. On such beans and pease may be given phosphoric acid and potash in suitable form.

It is not believed to be at all true, as claimed by some, that all soils are naturally well enough supplied with plant food to yield maximum crops if only their physical condition were made good enough. Probably half of the cotton lands, and practically all of the early trucking lands of the United States, would seem to be rather large exceptions to prove such a rule. Direct applications of plant-food elements certainly pay handsomely over large sections of country, and the soils giving best results for these applications would seem to be physically more nearly perfect than most other soils.

Animal manures added to land have very much the same effect as the plowing in of restorative crops, or green manuring. The effects of manure from cattle, carabaos, or horses running on the grass will not be materially different from those of plowing in the grasses eaten to produce the manure. It will be somewhat quicker to rot and yield up its plant food. It is true that animals will generally pick the tender blades of grass, the young clovers, etc., that make richer food and richer manure than the average grasses and weeds that would be likely to be plowed under. Animals eating grain, oil cake, beans, pease, or other rich food yield a richer and more valuable manure.

Where carabaos and pigs are kept, as they almost universally are in the islands, in deep mud, it would certainly never pay to attempt to move the manure in this condition to the fields. If these animals could be kept in large pasture lots, with small wallowing places, they would no doubt spend most of the time grazing on dry land, and most of the manure would be dropped there where it might be plowed under from time to time and the pasture lot moved. So many carabaos are generally kept on a large farm that much land might be made fertile in this way. Horses and cattle may be kept in dry sheds on suitable bedding, as is done in the States, and the manure kept under shelter and taken to the field from time to time. Poultry manure is much richer than any other farm manure available, and should be carefully saved and applied to the land.

There are few farms in any country so favorably situated that maximum yields and profits can continue without rotating the crops, buying concentrated fertilizer materials, or doing both.

Bat guanos are plentiful in some parts of the islands, but their composition is quite variable and none seem to be highly valuable. It is probably true that wet countries seldom possess highly valuable guano deposits. Except in the garrets of old churches, occasionally, these bird deposits are subject to leaching, at least during the wet season. Where this is the case the soluble nitrogen and phosphorus compounds are sure to be lacking. Guanos never have any potash of account. A few analyses so far made by the government laboratories of bat guanos follow, together with those of a few fertilizers and fertilizer materials whose compositions have either been determined here or are well known:

Name of material.	Nitrogen.	Avaiable phosphoric acid.	Potash.	Estimated value in Manila per ton, United States currency.
	Per cent.	*Per cent.*	*Per cent.*	*Dollars.*
Bat guano	4.25	4	Trace.	22.60
Do	7.28	.24	0.905	30.00
Do	6.47	.202	.495	26.63
Nitrate of soda	16	....	....	64.00
Sulphate ammonia	20	....	....	80.00
Dried blood	13	....	....	52.00
Cotton-seed meal	7	3	1.5	34.30
Castor-oil cake	5.5	2	1	26.20
Cocoanut cake	3	1.6	2.4	17.60
Acid phosphate, good quality	....	16	....	22.40
Double superphosphate, sold by V. Jimenez Tortosa	....	39	....	54.60
Ground bone	4	22	....	46.80
Sulphate of potash	....	....	53	74.20
Muriate of potash	....	....	50	70.00
Meat scrap, dried	12	....	....	48.00
Fish scrap, dried	8	6	....	40.40
A complete fertilizer (containing all these ingredients), sold by Andrews & Co. in 1903	10	1.14	1.14	42.80
An average complete fertilizer, as sold for cotton in the United States	2	8	2	22.00

The valuations assumed, while derived from actual selling prices of the materials in the States, plus a liberal margin for freight and handling here, do not necessarily bear any fixed relation to what a dealer will charge in Manila. The prices will generally be found higher than those assumed, but, in time, as fertilizers come to be dealt in on a larger scale, they will be handled more economically and sold on smaller margins.

FERTILIZER LAWS SUGGESTED.

Until such time as the Philippine Islands shall have laws enacted—such as are on the statute books of nearly every State in the Union, compelling all people dealing in fertilizers to have them analyzed and sold on a guaranty of quality—it will be much safer for planters to buy standard materials and mix them themselves than to buy ready-mixed fertilizers whose composition can not be detected. Until fertilizer laws became general and came to be rigidly enforced, the frauds practiced in the fertilizer trade were enormous. Of course, any buyer can protect himself by having fair samples of the fertilizers he buys analyzed before purchasing.

It would be well to bear in mind that nitrogen in its different forms is not equally available for plants. As a nitrate it is immediately ready to be absorbed by plants. Nitrate of soda applied to a grain or grass crop will often show its effects in two or three days in the dark-green color it gives the foliage of the crop. As it occurs in sulphate of ammonia, cotton-seed meal, or fish scrap, it must go through chemical changes in the soil, have its nitrogen combined with oxygen of the air, and be changed into nitrates before it can feed the plants. These changes require time, and hence the latter materials are not as quick in action as the nitrate of soda; but they last longer; and are often capable of furnishing nitrogen to a crop during its entire growth. Nitrate of soda, or any nitrate for that matter, is very easily washed from the soil, and hence should never be applied in large quantity during the wet season. A better practice at all times would be to apply this very soluble ingredient in small quantities to a growing crop, so that it may be immediately used. Applied in this way it has often proved to add such strength and vigor to a crop that its power of getting mineral food, phosphoric acid, and potash from the natural stores in the soil is greatly increased.

It can well be believed that, say, from 50 to 75 pounds of nitrate of soda, carefully sprinkled in the plow furrows near the sugar cane in April and May, when there is just rain enough to properly dissolve and distribute the material, would greatly stimulate growth, promote health and vigor, and result in quite a profitable increase in yield of sugar. This advice would presuppose that the land is not new, but old and worn, so as to need nitrogen, and, further, that the land is cleaned of weeds and grass at the time of the application, so that the cane can reap the entire benefit of the application. Such treatment would certainly be still more beneficial to a rattoon crop on any but quite fresh and new land. If large quantities of nitrogen are to be used, most of it should be given in the form of sulphate of ammonia or some animal or vegetable source, so that it may slowly become available and not be leached away and wasted.

One need not be so economical in the use of the minerals, phosphoric acid, and potash. These form rather stable compounds in the soil and do not wash away easily.

It would, no doubt, be better in a country like this, where crops have a long period of growth, not to apply all the chemical fertilizer at one time, but to use it in smaller quantities and make two or three applications. This is often found profitable, even where crops have a short season of growth, and where chances for loss are much less than here.

FERTILIZER MIXTURES, OR COMPLETE FERTILIZERS.

A complete fertilizer is one containing all three of the fertilizer ingredients. In making mixtures it has been found profitable to use a small quantity of the readily soluble nitrate of soda, and a larger quantity of the more slowly available nitrogen materials like sulphate of ammonia, cotton-seed meal, dried blood, or tankage. A mixture that ought to give good results here would be made up of 1,300 pounds of 16 per cent acid phosphate, 200 pounds nitrate of soda, 350 pounds sulphate of ammonia, and 150 pounds sulphate of potash. These materials should be thoroughly mixed together, and would make a ton of complete fertilizer, containing about 10.4 per cent available phosphoric acid, 5 per cent of nitrogen, and 3.75 per cent of potash. A mixture like this would be considered quite a high-grade complete fertilizer, and 500 to 800 pounds per acre would be considered a good application for cane or tobacco. A mixture of 1,250 pounds ground cocoanut-oil cake, 700 pounds 16 per cent acid phosphate, and 50 pounds sulphate of potash would make a mixture nearly as good as the average fertilizer sold for cotton in the States.

About twice the amount of this would be needed per acre as of the higher grade mixture.

Only tobacco, sugar cane, and a few other crops that have high-money value per acre are given these large applications of fertilizer. Corn would probably be given 150 to 300 pounds of high-grade fertilizer, and cotton not that much. Pease, peanuts, or velvet beans, would be given about 100 pounds acid phosphate mixed with 20 pounds muriate or sulphate of potash. Larger yields of crops, proportionately, are always gotten from small applications of fertilizers rather than from large applications. The best profits are usually obtained from moderate applications, rather than from very small or very large ones.

In making a mixture of fertilizers (we will say, for sugar cane), if the land is very much worn, as shown by a small growth of crop inclined to be yellow in color, it will likely be best to increase somewhat the nitrogen in the mixture. For rattoon crops a little more nitrogen would be needed than with the first year's crop. If the land is very sandy, a little more potash will probably be needed; while, if very stiff, less would be indicated. For a crop on somewhat new land, or land that has been lying idle or growing restorative crops so that the growing plants look green, vigorous, and flourishing, less nitrogen would be indicated as being necessary.

One can order from the manufacturers of fertilizers a mixture containing, say, 10 per cent available phosphoric acid, 5 per cent nitrogen (either or both forms discussed above), and 3 per cent of potash, or any other combination desired.

Contrary to popular opinion, soil analysis seldom teaches exactly what is needed to be used in fertilizers. It gives certain indications to one knowing how to interpret the results. Taken in connection with such observations as are mentioned above, it is believed a fairly correct answer can be given as to what crops need in the way of fertilizers.

RICE, HEMP, AND COCOANUTS.

So far very little is known experimentally as to the needs of these three staple crops of this archipelago. Rice is known to respond well to the use of restorative crops and animal manures in China and Japan. Its splendid growth on new, fresh land would plainly indicate its liking for nitrogen. Just how much the excessive amounts of water required for rice would complicate results in fertilizing rice with concentrated fertilizers is not known to the writer.

Hemp, too, flourishes remarkably on newly-cleared land full of humus. In a few years, after the excess of humus has disappeared from the land, the plants become yellow and unthrifty. They at least do their best when they have an abundant supply of nitrogen. It is also quite likely that phosphoric acid and potash are needed.

It is a matter of common observation that cocoanut trees near houses where they have yard sweepings, poultry manure, and other fertilizing substances bear many more and finer nuts than do those in the main part of a grove. J. Ferguson, author of the Cocoanut Palm, says it is well established that the trees need mainly nitrogen and phosphoric acid. He claims that with 70 trees per acre 500 pounds of cow manure per tree, well cultivated into the soil of mature trees have been known to increase the yield 4200 nuts per acre. Mr. Ferguson also says that poonac, or cocoanut-oil cake, and castor cake are fine fertilizers for cocoanut trees. The fact that the cocoanut is so often found growing on sandy beach land would indicate that potash may also be scarce enough to be used profitably together with the other ingredients.

BULLETINS

ON THE

CULTIVATION OF SUGAR CANE, CACAO, RICE, TOBACCO, AND COCOANUTS, AND THE INTRODUCTION AND DISTRIBUTION OF SEEDS AND PLANTS

IN THE

PHILIPPINE ISLANDS.

BUREAU OF AGRICULTURE.

(Farmers' Bulletin No. 1.)

A PRIMER ON THE CULTIVATION OF SUGAR CANE.

By William S. Lyon. 1902.

LETTER OF TRANSMITTAL.

Sir: I have the honor to transmit herewith, and to recommend for publication as a Farmers' Bulletin, the manuscript of a paper on "The cultivation of sugar cane."

The importance of the sugar industry to these islands can hardly be overstated. At the present time it furnishes all the sugar required for domestic consumption and a surplus for export, which, in 1900, amounted to 143,719,971 pounds, valued at $2,397,144, and, with the exception of hemp, this industry gives employment to more of our rural population than any other branch of agriculture. Diminished cane areas, diminished crops, and diminished profits entail suffering in the rural districts that extends far beyond the landed proprietor or owner of a sugar estate. Abandoned cane fields and idle mills throughout the archipelago indicate a depression of such magnitude as to render it incumbent upon this Bureau to do everything in its power to remedy these conditions.

The causes producing the present depression in the sugar industry, other than those resulting from the prevailing financial conditions and excessive rates of interest on mortgage loans, are to be found both upon the farm and in the mill. The present practices plainly indicate a lack of knowledge of certain fundamental principles in cane cultivation, and the purpose of this paper is to place before the cane grower in compact form the elementary information essential to the success which lies within his reach.

Respectfully,

William S. Lyon,
Expert in Tropical Agriculture.

Prof. F. Lamson-Scribner,
Chief, Insular Bureau of Agriculture.

INTRODUCTION.

Upon most modern estates the manufacture of sugar is carried on in connection with the growing of the cane, but this is not always the case, and cane growing alone may be profitably followed by those who have no milling plant, but who must deliver their crop to the nearest crushing mill.[a] The conditions for profitable returns are exceptionally favorable upon these Islands; the climate can not be surpassed, the cane soils are unequalled, there is abundant water supply, the facilities for transportation by water are unusually good, while the difficulties of land transportation will be quickly overcome by the successful planter. It must be the aim of the cane grower to produce upon a given area the maximum of both tonnage and quality in order to secure the greatest profit. This can only result from a judicious selection of land, both as to location and soil, a careful selection of the most productive varieties of cane, and the highest class of tillage and management of the growing crop.

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[a] This is the general practice in New South Wales, where the numerous holdings are, as a rule, small in area. The cane is purchased from the planters, principally by the Colonial Sugar Refining Company, whose various crushing mills and refineries are fitted with machinery of the most modern character.

LOCATION OF FARM.

The essential feature for the consideration of the grower who does not design to crush the cane himself lies in the accessibility of his farm to a mill. The measure of this accessibility will be determined entirely by the cost of transportation, which will depend on the condition of existing roads; the cost of construction of new ones, or of tramways; or the availability of waterways for more distant carriage. This last in these islands is so valuable a means of transportation that it can be utilized for the extention of cane growing into regions that otherwise could not be made available.

Most modern sugar mills are now equipped with unloading facilities, and by the aid of special labor-saving contrivances effect the discharge of cars, carts, and boat loads of cane with remarkable ease and celerity. These are all contributory factors to "accessibility" and are, therefore, mentioned in this connection.

The next feature that commands attention in the selection of a sugar-cane farm is the suitability of the soil for the designated purpose. It has been contended that sugar cane can be made profit-paying upon *any* land when the rainfall is sufficient and the other climatic conditions are favorable.

It is also conceded by the many authorities responsible for this contention that there are many requisites necessary to bring unsuitable lands to a state of productivity; and that, except in regions where the needed supplies are cheap and plentiful, it is inexpedient to attempt their reclamation to sugar growing. In the Philippines lands exceptionally well fitted for the growing of sugar cane are so abundant that there seems to be no valid reason for the selection of those that can only be reclaimed to this use by tedious and costly processes.

In determining the suitability of the soil we have, as a matter of first consideration, its physical or mechanical condition.

SOIL CONDITIONS.

With a possible exception of tobacco, there is no staple agricultural crop where the physical condition of the soil plays so important a part as it does in the growing of sugar cane. It is a plant that, by virtue of its great size and rapid growth, not only draws heavily upon the fertility of the soil, but its shallow root system and restricted area for each plant demands that the mechanical condition of the soil be such as to facilitate in every way the full exercise of the root's functions. In all regions and in all sugar-producing countries, a strong, deep, argilaceous, or slightly calcareous soil has always been found best fitted to meet these requirements.

In the sandy, sedimentary, alluvial soils along the sea coast, or in rich mountain valleys, heavily charged with the humus in which the cane rejoices, phenomenal crops are often taken, but for long-continued cropping and with a minimum of restoratives the soils first mentioned are those which have longest stood the crucial test of time.

Such lands as these abound in the archipelago and often extend for miles along the lower and easily cultivated foothills, and these to-day offer more inviting fields of operations than many of the apparently more alluring valley lands along the coast.

The land chosen must not be less than 1 foot in depth, but that will be sufficient, provided the substratum on which it rests is permeable to water. The perfect permeability of the subsoil is a sine qua non for the perfecting of the cane, for stagnant water at the roots is a more dangerous menace to success than long-continued drought. It is this peculiarity that clearly differentiates valley lands suited to cane growing from those adapted to rice, an aquatic grass, whose roots thrive in the same soil as the cane, but which must be underlaid by an impervious subsoil that will retain water throughout the growing season.

Nevertheless, the planter need not be discouraged who finds his shallow top soil underlaid by a formidable bed of clay. In most cases it will be found full of stones, bits of tufa of volcanic scoria, and, unless it lies perfectly level with the water table close to the surface, is at times susceptible to the free and rapid percolation of water.

It is suggested to the prospective cane planter who is unfamiliar with the physical character of the subsoil that he dike a small experimental plot of land, making his dikes as nearly waterproof as possible, and then observe the behavior of the land subsequent to one or two torrential rains, noting the tardiness or rapidity with which the water disappears. If, after a 2-inch rainfall upon soil previously wetted through, the water remains standing for more than two or three hours, a complete and comprehensive system of drainage is essential before putting such lands into cane.

SOIL FERTILITY.

Fertile soils can nearly always be assured in what are known as "virgin soils," and such are at present in almost unlimited quantities in these islands. It may seem paradoxical to say that on a narrow sea zone, densely peopled by a race who have been engaged in agriculture for generations, virgin lands are more abundant than in what we call a new country within temperate latitudes. Strictly speaking, such is not the fact, but within the Tropics, land that has once been cultivated and then allowed to lapse, so quickly reverts to its primitive condition that in a very few years it effects what would require a generation to accomplish in a northern climate and to all practical intents becomes once more virgin land. Such lands are more valuable in some respects than the undisturbed soil of the primeval forests. Their reclamation to cultivation is more cheaply effected, while the rapidity with which the processes of growth and decay progress in the Tropics, are assurance of a liberal supply of the humus, the one fertilizing agent of all others most vital to the highest perfection of the sugar cane.

In some tropical forest regions the remains of decaying vegetation are so great that they are sometimes present to an almost injurious excess.

On such soils, as also occasionally upon truly virgin sedimentary river bottoms, the cane develops to a size and with a luxuriance that is phenomenal; yet in this abnormally excited growth it frequently becomes gorged with unassimilated alkaline salts prejudicial to sugar-making, difficult to eliminate, and depreciative of the market value of the cane.

But the quasi virgin land that has only the accumulated vegetable detritus of a few years offers a happy medium for the growth of a strong, vigorous cane, rich in the precious saccharine matter that crystalizes freely and that always commands the highest price in the sugar mills of the world. Under the question of soil fertility it is pertinent to inquire if some practical suggestion can not be made whereby the equilibrium of the humus in the soil in relation to its mineral elements may be constantly maintained.

A piece of land by the irrefutable logic of good money returns may have demonstarted its superiority for growing cane; it may teem with the elements of soil fertility, yet in a few years the humus is depleted and the cane and its value rapidly begin to deteriorate. There can be no middle course—the exhausted humus supply must in some way be restored.

Humus, as we know, serves a two-fold purpose—one, purely mechanical in its effects, rendering stiff soils pervious to the aeration and moisture, without which perfect root action can not be maintained; the other, the added fertility which it supplies. It is rich in available nitrogen, without which, and not withstanding a surfeit of other fertilizing agents in the soil, there can be no successful issue to a cane crop.

The two materials known to common agricultural uses that most nearly approximate humus in their action are stable or barn manures and cotton-seed meal. Both these substances are not only rich in nitrogen, but both, while undergoing decomposition in the soil, exert mechanical influence analogous to that of humus.

In countries where cotton is grown and farm stock housed or corralled one or both of these invaluable agents are easily obtained, and no difficulty is experienced in growing a succession of cane crops and in preserving continuously normal soil conditions. In these islands we are practically excluded from the consideration of either, for cotton is not produced in commercial quantities and, outside of a few large cities, the stall feeding of farm animals is unknown, and consequently the use of barnyard manures is out of the question. In this extremity there is no alternative for the cane grower but to lay down his cane fields every third year to, say, cowpeas, vetches, or some leguminous crop that will compensate for the more direct fertilizers that he is unable to procure. As a result, one-third of his sugar fields will be annually unproductive of sugar. Nevertheless there is little doubt that eventually the farmer will be enriched by the operation. These renovating crops can first of all be partly cut and cured for forage, and will afford assured maintenance for the stock that is an indispensable condition to the profitable working of the farm. Stock so fed, if not immune, will at least be far less susceptible to epidemic diseases than those allowed to roam at large over pastures where the herds have previously been decimated by disease.

In addition, the yard feeding of his cattle will necessarily result in the accumulation of manures that if properly protected from leaching by rains will place at his command one of the best means for maintaining continued productivity. In the end, after the saving of the forage, there still remains the stubble, which, when plowed under, acts as humus, while the deep-rooting legumes have not only subsoiled his land, but have stored up while he slept an abundant supply of the nitrogen in the cheapest available way.

A practice in some places in the islands is for planters to "rest" their cane lands every alternate year. Such rests, it may be remarked, are quite as "tiring" to the land as its continuous production of cane. The rest does not last long enough to restore the growth that would in time renew it, nor is it even fallow plowed, which would at least greatly improve its mechanical condition. The "rest" is simply idleness, productive of ill rather than benefit.

PREPARATION OF THE SOIL.

If the land is what we now understand to be virgin soil the brush and timber will be cut closely to the ground,[a] any wood required for fuel removed, and the remaining tops and branches, when dry enough, gathered in small heaps and burned. Large fires are to be avoided, as the smoldering embers are apt to ignite and burn out much of the precious humus in the soil. It is on this account maintained that all trash should be removed and burned outside the plantation limits. Nevertheless, if the fires are kept small in size, the loss from this source will be inconsiderable and hardly great enough to compensate for the extra cost of handling or for the potassic salts lost by the removal of the brush from the ground; but, most important of all, the scattering and burning of the brush not only kills and facilitates the subsequent removal of the stumps, but helps to destroy the larvæ of pernicious insects that abound in most forest lands.

The grubbing of the stumps can not be profitably undertaken till the rains have thoroughly wet down the soil, and then small roots are easily taken out with a grub hoe, while larger ones that are well charred may be easily removed by carabao.

It is only the largest stumps that should be left to decay. This process is so rapid in this climate that their early extirpation is an easy matter. Unless of extraordinary density of foliage a few standing forest trees are seldom detrimental to field crops. To this the sugar cane is a notable exception. It rejoices in full, free, and unbroken sunlight at every stage of growth, and the greater its intensity and long continuance the greater the assurance of a good yield of sugar.

BREAKING THE SOIL.

The proper initial preparation of the soil presents probably the gravest difficulty with which the cane planter on these islands must contend. The lack of animals and implements adequate to open up and aerate the soil for all the depth to which it may be traversed by the cane roots is indispensable to success, and further on the only solution of this problem that now seems feasible will be presented. Where the initial preparation of the soil has been thorough there is little subsequent occasion for the use of implements of heavy draft. A few years ago the deep subsoil plow and the turning of the land for a foot or 14 inches was considered essential. Now the investigations of chemistry have demonstrated that the available, i. e., the readily assimilated plant food, is that which lies close to the surface, and that the deep burying of this surface soil and its replacement with elements not yet sufficiently disorganized to serve as plant food contained in the under soil is wasteful of both energy and material. As now understood deep plowing serves only a mechanical purpose and no more than to guarantee porosity and a free aeration of the underlying beds.

The subsoil plow has therefore been generally consigned to the things of the past (except for uses not pertinent to this subject) and it is regrettable to have to recommend its resurrection for some existing conditions in this archipelago. These conditions are mainly found upon the clay cane lands, where for many years the soil has been lightly skimmed with a small plow for a depth of 2 or 3 inches, and at this depth the soil is crusted with a polished, impermeable floor, which is the reverse of what is desired and which must be broken up and pulverized if these lands are to be made remunerative. That they bear unprofitable crops is no cause for surprise. The real cause of surprise is that they produce even half a crop of cane, and that they still do this speaks volumes for the wonderful adaptability of the climate and the remarkable fertility of the land itself. On such lands as these there seems no escape from the operation of the subsoiler, as no other implement will quite penetrate and open up this artificial hardpan. Upon virgin land any good deep-breaking plow will answer, although the modern disk plows that turn a furrow of any desired depth are preferred.

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[a] The writer has lately observed some interesting experiments in clearing, where the brush was topped at 3 to 4 feet from the ground. The supposition is that, in the process of grubbing, the standing butts can be used as levers for the expeditious and easy eradication of the stumps.

In this plow the rotating disk, instead of sliding along the furrow, leaving a compact bottom, releases the farmer forever from the perplexing question of future subsoilings. This disk plow, and the double-moldboard plow for the economical building up of beds and opening out drains are the only heavy draft implements required for the cultivation of cane. All subsequent tillage is prosecuted with light-draft disk harrows and cultivators of easy manipulation and should properly be considered under the head of "crop cultivation" rather than that of soil preparation. In stiff soils the disk plow can not be used with less than 3 good American horses or mules, and it is doubtful if it could be well operated in such lands with fewer than 6 carabaos. At this time, when the sugar districts of the islands have been almost depleted of their live stock, it seems inopportune to recommend the doubling up of draft animals by the use of heavy machinery. Still, it should be remembered that these plows throw a furrow slice of 20 to 24 inches and will readily and properly prepare 4 to 5 acres in a day, which is more than 6 carabaos will imperfectly accomplish in the same time with the small plow now in general use.

The question of the application of these useful implements to the preparation of cane lands, therefore, resolves itself into a question of motive power, and to the judgment of the farmer, who must decide if a possibly smaller acreage placed in a perfected condition does not offer greater inducements than a larger acreage illy prepared and fraught with prospects of crop failure.

Under the existing live stock conditions, no other suggestion can be made at this time than that given above of doubling up the available farm animals until the required motive power is secured, and it is recommended with the assurance that the farmer's gains from a smaller, well-handled acreage will more than compensate for the loss of acreage that this concentration of power implies.

In preparing valley land for planting, some provision must be made for times of food that does not apply to uplands. After the first heavy plowing the land is to be fined down with a good harrowing. If the soil is of free, open texture and handled at the time when still moist but not sticky, the common form of sectional harrow will do good work. If inclined to be cloddy the disk harrow will reduce the soil to the best condition of any tool in common use. The land is then to be laid off in 5-foot beds, the middles between them being opened up with a double-moldboard plow. In valley lands that have been kept in the best condition, it is here that the only occasion should arise for the use of the subsoil plow for the purpose of deeply opening up these middles, which will serve the double purpose of drainage and of supplying soil for the elevation of the beds. The depth or shallowness of these furrows will be governed by the susceptibility of the land to overflow.

In many tropical regions, and in most of the Philippines, the cane beds are only made 3½ to 4 feet apart, but where the highest skill is exercised and upon good soils the 5-foot planting should yield a tonnage equally large and at a great saving of expense in both labor and seed cane.

SELECTION OF SEED CANE.

The cane used for seed should always be well ripened and selected from such stools or "ratoons" as from mill tests show the most sucrose and the highest purity. Careful selection for a few years, and the reservation of a portion of the plantation for nursery purposes, will enable the planter to maintain his seed cane at a high standard of excellence. The varieties used here seem to be confined to the green and yellow sorts, of probable Javanese origin. These canes, though rich in sucrose, are generally small and insufficient in tonnage yield per acre. Further, and whenever there is a steady decrease in size from lack of proper cultural methods, the deterioration is accompanied with a relatively greater increase of fiber that, in its turn, represents another loss at the mill. The many useful striped, rose, and purple canes, that have contributed to bring Hawaii to the front as the most prolific and profitable sugar region in the world, have not, so far as can be ascertained, been planted in these islands.[a]

Exhaustive tests have definitely established the fact that the upper two or three feet of the cane—the part least valuable at the mills—is well suited to seed purposes, and that no sugar deterioration has occurred from its long-continued use. These tops can be all used, except the extreme tips, which are sometimes inclined to "arrow."

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[a] Through the commendable enterprise of Capt. G. P. Ahern, Chief of the Forestry Bureau, an importation of these Hawaiian canes was recently made to this country, and efforts will be made, by their rapid propagation and further introductions, to effect future distributions of the same to planters. F. L. S.

PLANTING.

As soon as the ground is prepared a shallow furrow or trench is opened down the center of the bed with a double-moldboard plow and the cane laid down in the trench, the end of one piece touching the next throughout the whole row. It is the custom, here and in Hawaii, to cut the cane into single nodes a few inches long and drop them at close intervals in the furrow. Such a practice undoubtedly assures a stand from every joint; but if the land has been brought to a fine condition of tilth and the whole of the cane is in intimate contact with the soil, every joint in the piece should break into bud. It will also be seen that the process is more expeditious and labor saving.

Previous to planting the seed cane should be soaked for two hours in lime water of the strength of 2 pounds of slaked lime to 1 gallon of water. This is recommended for the destruction of the eggs of pernicious insects; but in every instance a rigid scrutiny of the seed cane should always be made, and any piece that has been attacked by borers should be rejected. As a remedial measure I would place more faith in a soaking of the cane in well-diluted carbolic acid; but, in view of the fact that the lime dressing furnishes at once to the young plant an always-to-be-desired and necessary element of fertility, this time-honored custom of all countries may be generally adopted.

In this country the trench for planting may be shallow and the soil covered back with a light plow or disk harrow. Where irrigation is not to follow, or where rainfall is so great that the water-carrying capacity of the middles is apt to be overtaxed, all subsequent plowing or tillage should be toward the cane row, with the end in view of having it always above water.

AFTER-TREATMENT.

The cane when planted, if followed by good rains or by irrigation, should begin to sprout within a week of the time it is wetted down, and this is the time when the progressive farmer has recourse to the so-called mineral fertilizers for the increase of crop and the maintenance of soil equilibrium. Aside from the humus and the means of providing for it that has already been discussed, there are two essential ingredients of soil fertility that exist in all rich lands, but upon which the sugar cane makes extraordinary drains, and the application of these in the most available forms not only meets with an assured response in a marked increase of crop, but is a guaranty of a continued state of soil fertility that leaves the farm capital always unimpaired. These ingredients are phosphoric acid and potash, and there are apparently no insuperable obstacles in the way of obtaining either. The former is probably to be had from the many deposits of bat guano that exist in the archipelago, and wherever these deposits are found in caves or have been protected from rain they are almost certain to be rich in this valuable element. If the planter is remote from any such source or from any known phosphate deposits, there seems to be no alternative than its purchase and importation from the Sandwich Islands or the United States.

These salts are more useful in the form of acid phosphates, and are commercially known as "superphosphates" and carry from 10 to 20 per cent of soluble phosphoric acid, and their cost is always based wholly upon the percentage of the acid they carry. In any event the amount required is small (200 to 400 pounds per acre) and at any reasonable cost it should be obtained.

The supply of potash does not appear to be of such pressing concern with the cane planter. Not only, if his land has been cleared and burned over, there has been returned a considerable supply of this element, but the indications are that most of the sugar lands of the islands are already rich in potash. Without recourse to a chemical analysis there is a simple, practical test whereby the farmer can determine this question for himself. Let him select two or three or more small plats typical of as many different soils as the farm shows and lay them down for two or three years to different kinds of lucerns and clovers, giving them no manuring whatsoever. If the growth from these plats is luxuriant, and they only suffer from causes directly attributable to long-continued drought, he may reasonably conclude that his land is provided with enough potash to meet all the requirements of cane growing for many years.

In the use of acid phosphates or of bat guano there is a process that is both effective and economical for its application. It may be scattered lightly in the furrow at the time of cane planting; or, if it is used in the form of bat guano, and where it is probably in combination with valuable nitrates, a furrow may be opened close to the cane, and the fertilizer scattered lightly and evenly along both furrow and furrow slice, and then all harrowed down smoothly with a disk harrow. There are drills now in common use that are adjusted to deliver commercial fertilizers directly where required and in precise quantities, but careful hand sowing can be made equally effective.

It should be remembered in the application of manures of this class that they are exceedingly soluble, and the greatest benefit from their use occurs at the time when light showers are prevalent. If applied at the time when the heaviest and long-continued rains are anticipated, a very large proportion of the valuable elements will be leached out of the land and carried away in the middles and drains. For the rest, all the subsequent cultivation to be given until the rows are crowded with suckers, and the cane ready to lay by and ripen, is a constant but superficial stirring of the surface with either hoe or cultivator.

After every rain, or so soon thereafter as the soil will admit of working, this cultivation should never cease. It is the keynote of the successful issue of the crop, and all the careful soil preparation and soil amendments that have been bestowed in previous months are largely nullified if a hard, compact crust is permitted to form and remain upon the surface. When the rows are completely crowded with cane and the ground well shaded, this surface induration will no longer occur, and the planter can await the ripening of his crop with the assurance that every hour of toil expended upon cultivation will be many times repaid.

HARVESTING THE CROP.

When the cane is ripe, and this is easily determined by the cessation of growth and a general deepening in color, it is ready for harvesting. It should be cut very close, or even with the ground in this climate, and the tops and leaves trimmed off, when it is ready for delivery to the mill. The tops are then gathered and buried in trenches of moderately dry soil until required for planting. The leaves and trash are gathered and burned or else covered deeply in a furrow made by a double-moldboard plow and allowed to decay. Both processes have strong advocates among expert sugar growers, but the process to be most commended will depend on circumstances. If there be the slightest evidence of fungus growth or the presence indicated of any sap-sucking or cane-boring insect whatsoever, there is no option. Every vestige of refuse should be burned. If such is not the case and there is, on the other hand, difficulty in obtaining stable manures or other humus-making ingredients, burying the trash will go a long way toward the maintenance of soil fertility, and is the best solution of the question of its disposition.

MANAGEMENT OF STUBBLE.

At one time three-fourths of all the cane grown on these islands was from stubble crops. Now, by long-continued depletion of the land in many districts it has become necessary to lay down the land to new seed cane every year; and this system, despite its wastefulness, seems to be the only one that affords planters any assurance of even a half crop.

Where the lands are not hopelessly exhausted or facilities are at hand for their renovation, there is no excuse for this wasteful policy; and virgin land, or land that is maintained in rotation, should be profitably handled for the second or even a third year. The rational method of treating the plantation destined to be carried over a second season as stubble cane would be as follows: In the process of harvesting the soil will be more or less compacted by the trampling of the cane cutters, by the cleaners, and by the carabao used in hauling away the crop. A thorough and deep plowing is therefore once more necessary, and to this must be added a complete forking over of the land in the stubble row itself. This may be effected by hand, although there is a machine now in common use, known as a "stubble digger," which has a revolving, cultivator-toothed attachment that works up the soil effectively and with remarkable speed directly in the row, and, with a little care, rarely tears out a stubble root. From this point on the manurial treatment and cultivation of a stubble crop is a practical repetition of that given to the seed-cane crop. This, in fact, would be the outline indicated for continuous succession of crops were it not for the difficulties that confront the Philippine planter in the procurement of complete fertilizers and which imperatively call for a crop rotation every third year if he would preserve the maximum sugar yield for an indefinite time.

There is no reason why the third or rotation year should be operated at a loss or be given up wholly to soil recuperation. The method practiced in Mauritius, Reunion, and most of the French colonies would doubtless be successful and profitable here. The third year the same stubble is grubbed out, the land laid down as usual, and planted to corn. When this has made fair growth and begins to "tassel" out, the ground is sown broadcast to vetches, cowpeas, or some other quick leguminous soiling crop. A fair to good crop of corn is usually secured, and the leguminous forage is pastured down till the season comes for plowing it under and reseeding the land to cane. This pasturing can only be done without injury during the dry season, and the farmer who turns carabao in to pasture in wet cane lands is inflicting incalculable mischief that will take years of reparative treatment to overcome.

DRAINAGE AND IRRIGATION.

There are two subjects pertinent to the matter under consideration that will be made the subject of future bulletins and that can only be briefly touched upon in this paper. They are drainage and irrigation. The former is indispensable to attaining a maximum of success upon the littoral lowlands of these islands, and ultimately a comprehensive system of drains will control every well-equipped and well-managed plantation in the archipelago. The evil effects of stagnant water have been already pointed out, and the indispensable necessity of deep, broad, middle ditches and laterals, for the rapid diversion of storm waters, has been insisted on elsewhere. These middles and laterals, however, are but makeshifts offered for the immediate amelioration of water-logged cane fields until they can be otherwise properly reclaimed. Open drains, to be efficacious, must be constantly kept clean and in repair. This entails constant labor and a very considerable and unnecessary sacrifice of land. Stone-filled drains made of broken stone of graduated sizes are expensive, and in time are apt to become clogged with fine silt. Tile drains will be the final recourse, and the excellence and abundance of the clay and the skill shown by the Filipinos in its manipulation are additional reasons for advocating their use. The financial condition of the planters at this time justifies a recourse to the expedients previously mentioned, and the hope is expressed that the profits arising from a better scheme of cane growing may eventually enable them to place their fields in the highest and most profitable condition.

It is well known that a perfect system of tile drainage is almost a guaranty against the evil effects of drought. To those who lack full comprehension of the subject, it appears paradoxical that a system primarily designed to dispose of surplus water in the soil will, at the same time, act as an agent for its restoration. Such is the case, however, and on the principle that nature abhors a vacuum there can be no evaporation of the surface waters without a supply constantly being drawn from below to replace it. Further, this, like all water that is in motion, is pure, sanitary, and drawn upward through the cane roots in just such quantities as they can appropriate with the greatest benefit, and in dry seasons, unless in excess, never flows to waste in the drains. It is, in short, the auxiliary to the planter in the valley that irrigation is to the cane grower on the uplands.

The uplands promise to be of long-enduring value, and, ultimately, more profitable than the valleys. The abundant water supply that prevails in all the districts where sugar is now grown is available for the reclamation of immense areas to this purpose. Here the planter has positive and complete control of the situation. He is free from the ever-recurring possibility in tropical countries of disastrous flood or inundation, while the danger of protracted drought need not be considered as an element of crop failure. His control, in short, is so perfect that he can apply moisture at the times when it is most beneficial and withhold it completely as his crop approaches maturity, when continued rain or moisture would increase the sap in the cane, at the sacrifice and loss of the sucrose he has patiently striven to elaborate.

Large areas of these uplands are frequently quite level, or with a gentle slope toward the sea, and consequently present ideal conditions for the ready distribution of irrigating waters. Some of the most valuable lands are, however, more or less undulating, and although susceptible to irrigation, the successful manipulation of the water requires attention to some simple engineering problems, which are, however, too extensive for treatment at this time.

CONCLUSION.

In conclusion, it may be said that the rational treatment of sugar cane involves that it be forced, and forced constantly, from the day the cane first sprouts till it is ready to lay by and ripen. This forcing process can hardly be overdone, and involves an adequate water and food supply and such constant tillage and forcing as will enable it to assimilate every particle of the food and water given. A check of any kind is fatal to the fullest measure of success, and the cessation of the functions of growth for only a few days means the elaboration of starch and fiber in lieu of the sucrose we are after.

In common with every other form of vegetable life, vigor and luxuriance of growth affords more general immunity from the attacks of predacious insects or fungoid growths and a consequent saving from the losses which these entail.

GROWING SUGAR CANE IN HAWAII.

[Extract from a report on the agricultural resources and capabilities of Hawaii, by William C. Stubbs, Ph. D., published in Bulletin No. 95, United States Department of Agriculture, Office of Experiment Stations.]

The dominant crop in Hawaii is sugar. * * * Few places in the islands where cane can be grown at all will yield less than 30 to 40 tons per acre * * *.

The table lands surrounding the islands at elevations of from 20 to 500 feet constitute the chief sugar areas. * * * There are about 60 plantations on the islands, which yielded in 1898–99 about 300,000 tons of sugar. These plantations have about 100,000 acres in cane, one-half of which is harvested every year. * * * Under irrigation as much as 10½ tons of sugar per acre has been the average of one plantation * * *.

Table showing expenses per ton of sugar grown, and per acre.

Plant cane.	Per ton.	Per acre.
Clearing	$0.54	$5.51
Mule and steam plowing	1.41	14.50
Ditches	.20	2.05
Cutting and hauling seed	.80	8.22
Preparing and planting	.88	9.04
Fertilizing	4.01	41.13
Watering	3.63	37.18
Hoeing and weeding	.76	7.85
Stripping	1.49	15.25
Cutting and hauling cane	3.48	35.62
Pumping expense	2.42	24.84
Sundry accounts (rent, interest, and all other expenses)	5.33	54.63
Manufacture	2.65	27.15
Containers	.99	9.77
Total	28.59	292.74

Plant cane:

Total yield of cane	tons.	117,835
Yield of cane per acre	do..	78.9
Purity of juice	per cent.	87.07
Amount of cane required to produce 1 ton of sugar	tons.	7.71
Total production of sugar	do..	15,289.5
Yield sugar per acre	do..	10.24

On the leeward side of the islands, where irrigation is practiced, the land is broken with steam plows to a great depth. Rows are laid off at 5-foot intervals with very deep double-moldboard plows. Into these deep furrows the tops of the cane are dropped in a continuous row, the soil is drawn in lightly with hoes and a shallow stream of water sent over the buried tops. In six to seven days a continuous stand of young canes is obtained. For the purpose of economizing water the rows are laid off as nearly on a level as possible, and an open furrow for irrigating is maintained during growth. After each irrigation hoes draw in from the adjoining ridges small quantities of soil in order to conserve the moisture applied. Save irrigation and its incident hoe work and the trashing of cane no other cultivation is given. A contract is usually made with a head Chinaman to irrigate and trash the cane from planting to harvest at so much per ton of cane harvested. The contract is usually for 100 acres, the company furnishing the water. Contracts are also made by the ton for the cutting and delivery of the cane at the sugarhouse, the company furnishing the cars and engines. The breaking of the land and the planting of the cane is usually done with hired labor.

On the rainy or windward side of the island the conditions require entirely different methods from those just described. The lands are broken in a similar manner, but less deeply, and the tops are planted in an open furrow and covered. When the plants are large enough, the work of cultivation begins, which is usually done with plows, cultivators, and hoes. This cultivation is continued until the canes are sufficiently advanced to "lay by." Every operation is similar to the best practice in the cornfields of the West. Here reliance is placed entirely upon the rainfall for furnishing the needed moisture to canes. Sometimes the rainfall is excessive, at others deficient. Severe and protracted droughts, which occasion great loss to the planters, occur at rare intervals. As a rule, however, the rainfall is ample for good crops, and the extra expense of irrigation is avoided. Hence frequently the windward plantations are just as good dividend payers as the leeward estates, though the yields per acre are much less. Trashing of cane is practiced here as on the leeward side. In both instances the dead leaves are piled up between the rows, where they remain until after harvest, when they are burned. "Ratooning" or "stubbling" is not largely practiced. Only first-year ratoons or stubbles are cultivated. Whenever, in the judgment of the manager, these will not produce 30 tons of cane per acre they are plowed up and the land replanted. Just here is one of the secrets of the large success attending sugar growing on these islands. Two-thirds, if not three-fourths, of the area each year is in plant cane. In Cuba, Porto Rico, and other tropical islands cane is permitted to run for six to even sixteen years, with the unavoidable result of annually diminished acre yields and a low average sugar output. Sugar planters elsewhere are disposed to doubt the accuracy of the large published yields of Hawaii. Let them consider their own enormous yields from plant cane and then apply such results to their entire plantations before they begin to question outputs obtained in these islands. It is true that irrigation upon fresh lands, upon the warmer leeward sides, in a climate almost perfect for maximum growth, has greatly increased the average output of Hawaii, but the carrying of the largest portion of the crop as plant cane is unquestionably the main cause of the large yields. This is evidenced by the yield obtained on the rainy or windward side of the islands, which are much larger than those obtained in Cuba and other tropical countries, even though much below the returns of the irrigated plantations on the lee side of the same islands.

The cane when harvested is delivered to the sugar mills by wagons drawn by oxen or mules, by rail, with horses or steam, by water flumes sometimes crossing deep gulches, and by trolleys. Plantations use either one of the above methods to suit their peculiar environments.

BUREAU OF AGRICULTURE.

(Farmers' Bulletin No. 2.)

CACAO CULTURE IN THE PHILIPPINES.

By William S. Lyon, 1902.

LETTER OF TRANSMITTAL.

Sir: I submit herewith an essay on the cultivation of cacao, for the use of planters in the Philippines. This essay is prompted, first, because much of the cacao grown here is of such excellent quality as to induce keen rivalry among buyers to procure it at an advance of quite 50 per cent over the common export grades of the Java bean, notwithstanding the failure on the part of the local grower to "process" or cure the product in any way; second, because in parts of Mindanao and Negros, despite ill treatment or no treatment, the plant exhibits a luxuriance of growth and wealth of productiveness that demonstrates its entire fitness for those regions and leads us to believe in the successful extension of its propagation throughout these islands; and lastly because of the repeated calls upon the chief of the agricultural bureau for literature or information bearing upon this important horticultural industry.

The importance of cacao-growing in the Philippines can hardly be overestimated. Recent statistics place the world's demand for cacao (exclusive of local consumption) at 200,000,000 pounds, valued at more than $30,000,000 gold.

There is little danger of overproduction and consequent low prices for very many years to come. So far as known, the areas where cacao prospers in the great equatorial zone are small, and the opening and development of suitable regions has altogether failed to keep pace with the demand.

The bibliography of cacao is rather limited, and some of the best publications,[a] being in French, are unavailable to many. The leading English treatise, by Professor Hart[b] admirable in many respects, deals mainly with conditions in Trinidad, West Indies, and is fatally defective, if not misleading, on the all-important question of pruning.

The life history of the cacao, its botany, chemistry, and statistics are replete with interest, and will, perhaps, be treated in a future paper.

Respectfully,

Wm. S. Lyon,
In Charge of Seed and Plant Introduction.

Hon. F. Lamson-Scribner,
Chief of the Insular Bureau of Agriculture.

INTRODUCTION.

Cacao in cultivation exists nearly everywhere in the archipelago. I have observed it in several provinces of Luzon, in Mindanao, Joló, Basilan, Panay, and Negros, and have well-verified assurances of its presence in Cebú, Bohol, and Masbate, and it is altogether reasonable to predicate its existence upon all the larger islands anywhere under an elevation of 1,000, or possibly 1,200, meters. Nevertheless, in many localities the condition of the plants is such as not to justify the general extension of cacao cultivation into all regions. The presence of cacao in a given locality is an interesting fact, furnishing a useful guide for investigation and agricultural experimentation; but as the purpose of this paper is to deal with cacao growing from a commercial standpoint, it is well to state that wherever reference is made to the growth, requirements, habits, or cultural treatment of the plant the commercial aspect is alone considered. As an illustration, attention is called to the statement made elsewhere, that "cacao exacts a minimum temperature of 18°," although, as is perfectly well known to the writer, its fruit has sometimes matured where the recorded temperatures have fallen as low as 10°. There is much to be learned here by experimentation, for as yet the cultivation is primitive in the extreme, pruning of any kind rudimentary or negative, and "treatment" of the nut altogether unknown.

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[a] Le Cacaoyer, par Henri Jumelle. Culture de Cacaoyer dans Gaudaloupe par Dr. Paul Guerin.

[b] Cacao, by J. H. Hart, F. L. S. Trinidad.

Elsewhere in cacao-producing countries its cultivation has long passed the experimental stage, and the practices that govern the managemnment of a well-ordered cacao plantation are as clearly defined as those of an orange grove in Florida or a vineyard in California.

In widely scattered localities the close observer will find many young trees that in vigor, color, and general health leave nothing to be desired, but before making final selection for a plantation he should inspect trees of larger growth for evidences of "die back" of the branches. If "die back" is present, superficial examination will generally determine if it is caused by neglect or by the attacks of insects. If not caused by neglect or insect attacks, he may assume that some primary essential to the continued and successful cultivation of the tree is wanting, and that the location is unsuited to profitable plantations.

With due regard to these preliminary precautions and a close oversight of every subsequent operation, there is no reason why the growing of cacao may not ultimately become one of the most profitable horticultural enterprises that can engage the attention of planters in this archipelago.

CLIMATE.

It is customary, when writing of any crop culture, to give precedence to site and soil, but in the case of cacao these considerations are of secondary importance, and while none of the minor operations of planting, pruning, cultivation, and fertilizing may be overlooked, they are all outweighed by the single essential—*climate.*

In general, a state of atmospheric saturation keeps pace with heavy rainfall, and for that reason we may successfully look for the highest relative humidity upon the eastern shores of the archipelago, where the rainfall is more uniformly distributed over the whole year, than upon the west.

There are places where the conditions are so peculiar as to challenge especial inquiry. We find on the peninsula of Zamboanga a recorded annual mean rainfall of only 888 mm., and yet cacao (unirrigated) exhibits exceptional thrift and vigor. It is true that this rain is so evenly distributed throughout the year that every drop becomes available, yet the total rainfall is insufficient to account for the very evident and abundant atmospheric humidity indicated by the prosperous conditions of the cacao plantations. The explanation of this phenomenon, as made to me by the Rev. Father Algué, of the Observatory of Manila, is to the effect that strong equatorial ocean currents constantly prevail against southern Mindanao, and that their influence extend north nearly to the tenth degree of latitude. These currents, carrying their moisture-laden atmosphere, would naturally affect the whole of this narrow neck of land and influence as well some of the western coast of Mindanao, and probably place it upon the same favored hygrometric plane as the eastern coast, where the rainfall in some localities amounts to 4 meters a year.

While 2,000 mm. of mean annual rainfall equably distributed is ample to achieve complete success, it seems almost impossible to injure cacao by excessive precipitation. It has been known to successfully tide over inundation of the whole stem up to the first branches for a period covering nearly a month.

Irrigation must be resorted to in cases of deficient or unevenly distributed rainfall, and irrigation is always advantageous whenever there is suspension of rain for a period of more than fifteen days.

Concerning temperatures, the best is that with an annual mean of 26° to 28°, with 20° as the mean minimum where any measure of success may be expected. A mean temperature of over 30° is prejudicial to cacao growing.

The last, but not least, important of the atmospheric phenomena for our consideration are the winds. Cacao loves to "steam and swelter in its own atmosphere," and high winds are inimical, and even refreshing breezes are incompatible with the greatest success. As there are but few large areas in these islands that are exempt from one or other of our prevailing winds, the remedies that suggest themselves are: The selection of small sheltered valleys where the prevailing winds are directly cut off by intervening hills or mountains; the plantation of only small groves in the open, and their frequent intersection by the plantation of rapid-growing trees; and, best of all, plantings made in forest clearings, where the remaining forested lands will furnish the needed protection.

LOCATION.

It is always desirable to select a site that is approximately level or with only enough fall to assure easy drainage. Such sites may be planted symmetrically and are susceptible to the easiest and most economical application of the many operations connected with a plantation.

Provided the region is well forested and therefore protected from sea breezes, the plantation may be carried very near to the coast, provided the elevation is sufficient to assure the grove immunity from incursions of tide water, which, however much diluted, will speedily cause the death of the plants.

Excavations should be made during the dry season to determine that water does not stand within 1½ meters of the surface, a more essential condition, however, when planting is made "at stake" than when nursery-reared trees are planted.

Hillsides, when not too precipitous, frequently offer admirable shelter and desirable soils, but their use entails a rather more complicated system of drainage, to carry away storm water without land washing, and for the ready conversion of the same into irrigating ditches during the dry season. Further, every operation involved must be performed by hand labor, and in the selection of such a site the planter must be largely influenced by the quantity and cost of available labor.

The unexceptionable shelter, the humidity that prevails, and the inexhaustible supply of humus that is generally found in deep forest ravines frequently lead to their planting to cacao where the slope is even as great as 45°. Such plantations, if done upon a considerable commercial scale, involve engineering problems and the careful terracing of each tree, and, except for a dearth of more suitable locations, is a practice that has little to commend it to the practical grower.

THE SOIL.

Other things being equal, preference should be given to a not too tenacious, clayey loam. Selection, in fact, may be quite successfully made through the process of exclusion, and by eliminating all soils of a very light and sandy nature, or clays so tenacious that the surface bakes and cracks while still too wet within 3 or 4 inches of the surface to operate with farm tools. These excluded still leave a very wide range of silt, clay, and loam soils, most of which are suitable to cacao culture.

Where properly protected from the wind a rocky soil, otherwise good, is not objectionable; in fact, such lands have the advantage of promoting good drainage.

PREPARATION OF THE SOIL.

When the plantation is made upon forest lands, it is necessary to cut and burn all underbrush, together with all timber trees other than those designed for shade. If such shade trees are left (and the advisability of leaving them will be discussed in the proper place), only those of the pulse or bean family are to be recommended. It should also be remembered that, owing in part to the close planting of cacao and in part to the fragility of its wood and its great susceptibility to damage resulting from wounds, subsequent removal of large shade trees from the plantation is attended with difficulty and expense, and the planter should leave few shade trees to the hectare. Clearing the land should be done during the dry season, and refuse burned in situ, thereby conserving to the soil the potash salts so essential to the continued well-being of cacao.

The land should be deeply plowed, and, if possible, subsoiled as well, and then, pending the time of planting the orchard, it may be laid down to corn, cotton, beans, or some forage plant. Preference should be given to "hoed crops," as it is essential to keep the surface in open tilth, as well as to destroy all weeds.

The common practice in most cacao-growing countries is to simply dig deep holes where the trees are to stand, and to give a light working to the rest of the surface just sufficient to produce the intermediate crops. This custom is permissible only on slopes too steep for the successful operation of a sidehill plow, or where from lack of draft animals all cultivation has to be done by hand.

Cacao roots deeply, and with relatively few superficial feeders, and the deeper the soil is worked the better.

DRAINAGE.

The number and size of the drains will depend upon the amount of rainfall, the contour of the land, and the natural absorbent character of the soil. In no case should the ditches be less than 1 meter wide and 60 centimeters deep, and if loose stones are at hand the sloping sides may be laid with them, which will materially protect them from washing by torrential rains.

These main drains should all be completed prior to planting. Connecting laterals may be opened subsequently, as the necessities of further drainage or future irrigation may demand; shallow furrows will generally answer for these laterals, and as their obliteration will practically follow every time cultivation is given, their construction may be of the cheapest and most temporary nature. Owing to the necessity of main drainage canals and the needful interplanting of shade plants between the rows of cacao, nothing is gained by laying off the land for planting in what is called "two ways," and all subsequent working of the orchard will consequently be in one direction.

THE PLANTATION.

Cacao, relatively to the size of the tree, may be planted very closely. We have stated that it rejoices in a close, moisture-laden atmosphere, and this permits of a closer planting than would be admissible with any other orchard crop.

In very rich soil the strong-growing Forastero variety may be planted 3.7 meters apart each way, or 745 trees to the hectare, and on lighter lands this, or the more dwarf-growing forms of Criollo, may be set as close as 3 meters or rather more than 1,000 trees to the hectare.

The rows should be very carefully lined out in one direction and staked where the young plants are to be set, and then (a year before the final planting) between each row of cacao a line of temporary shelter plants are to be planted. These should be planted in quincunx order, i. e., at the intersecting point of two lines drawn between the diagonal corners of the square made by four cacaos set equidistant each way. This temporary shelter is indispensable for the protection of the young plantation from wind and sun.

The almost universal custom is to plant, for temporary shelter, suckers of fruiting bananas, but throughout the Visayas and in southern Luzon I think abacá could be advantageously substituted. It is true that, as commonly grown, abacá does not make so rank a growth as some of the plantains, but if given the perfect tillage which the cacao plantation should receive and moderately rich soils, abacá ought to furnish all necessary shade. This temporary shade may be maintained till the fourth or fifth year, when it is to be grubbed out and the stalks and stumps, which are rich in nitrogen, may be left to decay upon the ground. At present prices the four or five crops which may be secured from the temporary shelter plants ought to meet the expenses of the entire plantation until it comes into bearing.

In the next step, every fourth tree in the fourth or fifth row of cacao may be omitted and its place filled by a permanent shade tree. The planting of shade trees or "madre de cacao" among the cacao has been observed from time immemorial in all countries where the crop is grown, and the primary purpose of the planting has been for shade alone. Observing that these trees were almost invariably of the pulse or legume family, the writer, in the year 1892, raised the question, in the Proceedings of the Southern California Horticultural Society, that the probable benefits derived were directly attributable to the abundant fertilizing microorganism developed in the soil by these leguminous plants rather than the mechanical protection they afforded from the sun's rays.

To Mr. O. F. Cook, of the United States Department of Agriculture, however, belongs the credit of publishing, in 1901,[a] a résumé of his inquiries into the subject of the shades used for both the coffee and the cacao, and which fully confirmed the previous opinions that the main benefit derived from these trees was their influence in maintaining a constant supply of available nitrogen in the soil.

That cacao and its wild congenors naturally seek the shelter of well-shaded forests is well established, but having seen trees in these islands that were fully exposed at all times showing no evidences of either scald, burn, or sun spot and in every respect the embodiment of vigor and health we are fully justified in assuming that here the climatic conditions are such as will permit of taking some reasonable liberties with this time-honored practice and supply needed nitrogen to the soil by the use of cheap and effective "catch crops" such as cowpeas or soy beans.

Here, as elsewhere, an Erythrina, known as "dap-dap," is a favorite shade tree among native planters. The rain tree (*Pithecolobium saman*) is also occasionally used, and in one instance only have I seen a departure from the use of the Leguminosæ, and that in western Mindanao there is a shade plantation composed exclusively of *Cananga odorata*, locally known as ilang-ilang.

While not yet prepared to advocate the total exclusion of all shade trees, I am prepared to recommend a shade tree, if shade trees there must be, whose utility and unquestioned value has singularly escaped notice. The tree in question, the Royal Ponciana (*Poinciana regia*), embodies all of the virtues that are ascribed to the best of the pulse family, is easily procured, grows freely and rapidly from seed or cutting, furnishes a minimum of shade at all times, and in these islands becomes almost leafless at the season of maturity of the largest cacao crop, when the greatest sun exposure is desired.

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[a] "Shade in Coffee Culture." U. S. Dept. Ag., Washington, 1901.

The remaining preparatory work consists in the planting of intersecting wind-breaks at intervals throughout the grove and upon sides exposed to winds or where a natural forest growth does not furnish such a shelter belt. Unless the plantation lies in a particularly protected valley, no plantation, however large in the aggregate, should cover more than 4 or 5 hectares unbroken by at least one row of wind-break trees. Nothing that I know of can approach the mango for this purpose. It will hold in check the fiercest gale and give assurance to the grower that after any storm his cacao crop is still on the trees and not on the ground, a prey to ants, mice, and other vermin.

SELECTION OF VARIETIES.

All the varieties of cacao in general cultivation may be referred to three general types, the Criollo, Forastero, and Calabacillo, and of these those that I have met in cultivation in the archipelago are the first and second only. The Criollo is incomparably the finest variety in general use, and may perhaps be most readily distinguished by the inexperienced through the ripe but unfermented seed or almond, as it is often called. This, on breaking, is found to be whitish or yellowish-white, while the seeds of those in which the Forastero or Calabacillo blood predominates are reddish, or, in the case of Forastero, almost violet in color. For flavor, freedom from bitterness, facility in curing, and high commercial value, the Criollo is everywhere conceded to be *facile princeps*.

On the other hand, in point of yield, vigor, freedom from disease, and compatibility to environment it is not to be compared with the others. Nevertheless, where such perfect conditions exist as are found in parts of Mindanao, I do not hesitate to urge the planting of Criollo. Elsewhere, or wherever the plantation is tentative or the conditions not very well known to the planter, the Forastero is to be recommended. The former is commercially known as "Caracas" and "old red Ceylon," and may be obtained from Ceylon dealers; and the latter, the Forastero, or forms of it which have originated in the island, can be procured from Java.

It seems not unlikely that the true Forastero may have been brought to these islands from Acapulco, Mexico, two hundred and thirty-two years ago,[a] as it was at that time the dominant kind grown in southeastern Mexico, and, if so, the place where the pure type would most likely be found in these islands would be in the Camarines, southern Luzon. Aside from the seed characters already given, Forastero is recognized by its larger, thicker, more abundant, and rather more abruptly pointed fruit than Criollo, and its coarse leaves, which are from 22 to 50 centimeters long by 7 to 13 centimeters wide, dimensions nearly double those reached by the Criollo or Calabacillo varieties.

PLANTING.

Planting may be done "at stake" or from the nursery. For the unskilled or inexperienced planter, who has means at hand to defray the greater cost, planting "at stake" is perhaps to be recommended. This is no more than the dropping and lightly covering, during the rainy season, of three or four seeds at the stake where the plant is to stand, protecting the spot with a bit of banana leaf, left till the seeds have sprouted, and subsequently pulling out all but the one strongest and thriftiest plant.

The contingencies to be met by this system are many. The enemies of the cacao seed are legion. Drought, birds, worms, ants, beetles, mice, and rats will all contribute their quota to prevent a good "stand" and entail the necessity of repeated plantings. Success by planting "at stake" is so doubtful that it is rarely followed by experienced planters.

The consequent alternative lies in rearing seedlings in seed beds that are under immediate control, and, when the plants are of sufficient size, in transplanting them to their proper sites in the orchard. In view of the remarkably short-lived vitality of the cacao seed, it is in every way advisable that the untrained grower procure his plants from professional nurserymen; or, if this resource is lacking, that he import the young plants in Wardian cases from some of the many firms abroad who make a specialty of preparing them for foreign markets.

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[a] According to "Historia de Filipinas," by P. Fr. Gaspar de S. Augustin, cacao plants were first brought here in the year 1670 by a pilot named Pedro Brabo, of Laguna Province, who gave them to a priest of the Camarines named Bartoleme Brabo.

Both of these expedients failing, then it is advised that the seeds be sown one by one in small pots, or, if these are not procurable, in small bamboo tubes, and, for the sake of uniform moisture, plunge them to their rims in any free, light soil in a well-shaded easily protected spot where they may be carefully watered. In three to six months (according to growth) the tube with its included plant may be planted in the open field, when the former will speedily decompose and the growth of the cacao proceed without check or injury.

At best, all of the above suggested methods are but crude expedients to replace the more workmanlike, expeditious, and satisfactory process of planting the conventional nursery grown stock. There is nothing more difficult in the rearing of cacao seedlings than in growing any other evergreen fruit tree. Briefly stated, it is only the finding of a well-prepared, well-shaded seed bed and sowing the seeds in rows or drills, and, when the seedlings are of proper size, in lifting and transferring them to the plantation. But in actual practice there are many details calling for the exercise of trained judgment from the preparation of the seed bed down to the final process of "hardening off," concerning which the reader is referred to the many available text-books on general nursery management.

It may be said for the benefit of those unable to adopt more scientific methods: Let the seed bed be selected in a well-shaded spot, and, if possible, upon a rather stiff, plastic, but well-drained soil. After this is well broken up and made smooth, broadcast over all 3 or 4 inches of well-decomposed leaf mold mixed with sand, and in this sow the seed in furrows about 1 inch deep. This sowing should be made during the dry season, not only to avoid the beating and washing of violent storms, but to have the nursery plants of proper size for planting at the opening of the rainy season. The seed bed should be accessible to water, in order that it may be conveniently watered by frequent sprinklings throughout the dry season.

The rich top dressing will stimulate the early growth of the seedling, and when its roots enter the heavier soil below it will encourage a stocky growth. Four or five months later the roots will be so well established in the stiffer soil that if lifted carefully each plant may be secured with a ball of earth about its roots, placed in a tray or basket, and in this way carried intact to the field. Plants thus reared give to the inexperienced an assurance of success not always obtained by the trained or veteran planter of bare-rooted subjects.

CULTIVATION.

Planters are united in the opinion that pruning, cutting, or in any way lacerating the roots is injurious to the cacao, and in deference to this opinion all cultivation close to the tree should be done with a harrow-tooth cultivator, or shallow scarifier. All intermediate cultivation should be deep and thorough, whenever the mechanical condition of the soil will permit it. A plant stunted in youth will never make a prolific tree; early and continuous growth can only be secured by deep and thorough cultivation.

Of even more consideration than an occasional root cutting is any injury, however small, to the tree stem, and on this account every precaution should be taken to protect the trees from accidental injury when plowing or cultivating. The whiffletree of the plow or cultivator used should be carefully fendered with rubber or a soft woolen packing that will effectually guard against the carelessness of workmen. Wounds in the bark or stem offer an inviting field for the entry of insects or the spores of fungi, and are, furthermore, apt to be overlooked until the injury becomes deep seated and sometimes beyond repair.

With the gradual extension of root development, cultivation will be reduced to a narrow strip between the rows once occupied by the plantain or the abaca, but, to the very last, the maintenance of the proper soil conditions should be observed by at least one good annual plowing and by as many superficial cultivations as the growth of the trees and the mechanical state of the land will admit.

PRUNING.

When left to its own resources the cacao will fruit for an almost indefinite time. When well and strenuously grown it will bear much more abundant fruit from its fifth to its twenty-fifth year, and by a simple process of renewal can be made productive for a much longer time.

A necessary factor to this result is an annual pruning upon strictly scientific lines. The underlying principle involved is, primarily, the fact that the cacao bears its crop directly upon the main branches and trunk, and not upon spurs or twigs; secondly, that wood under three years is rarely fruitful, and that only upon stems or branches of five years or upward does the maximum fruitfulness occur; that the seat of inflorescence is directly over the axil of a fallen leaf, from whence the flowers are born at irregular times throughout the year.

With this necessary, fundamental information as a basis of operations, the rational system of pruning that suggests itself is the maintenance of as large an extension at all times of straight, well-grown mature wood and the perfecting of that by the early and frequent removal of all limbs or branches that the form of the tree does not admit of carrying without overcrowding.

It is desirable that this extension of the branch system should be lateral rather than vertical, for the greater facility with which fruit may be plucked and possible insect enemies fought; and on this account the leading growths should be stopped when a convenient height has been attained.

When well grown and without accident to its leader, the cacao will naturally branch at from 1 to 1.4 meters from the ground. These primary branches are mostly three to five in number, and all in excess of three should be removed as soon as selection can be made of three strongest that are as nearly equidistant from each other as may be. When these branches are from 80 centimeters to 1 meter long, and preferably the shorter distance, they are to be stopped by pinching the extremities. This will cause them and the main stem as well to "break," i. e., to branch in many places.

At this point the vigilance and judgment of the planter are called into greater play. These secondary branches are, in turn, all to be reduced as were the primary ones, and their selection can not be made in a symmetrical whorl, for the habit of the tree does not admit of it, and the selection of the three should be made with reference to their future extention, that the interior of the tree should not be overcrowded and that such outer branches be retained as shall fairly maintain the equilibrium of the crown.

This will complete the third year and the formative stage of the plant. Subsequent prunings will be conducted on the same lines, with the modification that when the secondary branches are again cut back, the room in the head of the tree will rarely admit of more than one, at most two, tertiary branches being allowed to remain. When these are grown to an extent that brings the total height of the tree to 3 or 4 meters, they should be cut back annually, at the close of the dry season. Such minor operations as the removal of thin, wiry, or hide-bound growths and all suckers suggest themselves to every horticulturist, whether he be experienced in cacao growing or not. When a tree is exhausted by overbearing, or has originally been so ill formed that it is not productive, a strong sucker or "gourmand" springing from near the ground may be encouraged to grow. By distribuitng the pruning over two or three periods, in one year the old tree can be entirely removed and its place substituted by the "gourmand." During the third year flowers will be abundant and some fruit will set, but it is advisable to remove it while small and permit all of the energy of the plant to be expended in wood making.

From what we know of its flowering habit, it is obvious that every operation connected with the handling or pruning of a cacao should be conducted with extreme care, to see that the bark is never injured about the old leaf scars, for to just the extent it is so injured is the fruit-bearing area curtailed. Further, no pruning cut should ever be inflicted, except with the sharpest of knives and saws, and the use of shears, that always bruise to some extent, is to be avoided. All the rules that are laid down for the guidance of the pruning of most orchard trees in regard to clean cuts, sloping cuts, and the covering of large wounds with tar or resin apply with fourfold force to the cacao. Its wood is remarkably spongy and an easy prey to the enemies ever lying in wait to attack it, and the surest remedies for disease are preventive ones, and by the maintenance of the bark of the tree at all times in the sound condition we are assured that it is best qualified to resist invasion. Of the great number of worm-riddled trees to be seen in the archipelago, it is easy in every case to trace the cause to the neglect and brutal treatment which left them in a condition to invite the attacks of disease of every kind.

HARVEST.

The ripening period of cacao generally occurs at two seasons of the year, but in these islands the most abundant crop is obtained at about the commencement of the dry season, and the fruits continue to ripen for two months or longer. The time of its approaching maturity is easily recognized by the tyro by the unmistakable aroma of chocolate that pervades the orchard at that period, and by some of the pods turning reddish or yellow, according to the variety.

The pods are attached by a very short stalk to the trunk of the tree, and those within reach of the hand are carefully cut with shears. Those higher up are most safely removed with an extension American tree pruner. A West Indian hook knife with a cutting edge above and below and mounted on a bamboo pole, if kept with the edges very sharp, does excellently well, but should only be intrusted to the most careful workmen. There is hardly a conceivable contingency to warrant the climbing of a cacao tree. If it should occur, the person climbing should go barefooted. As soon as the fruit, or so much of it as is well ripened, has been gathered, it is thrown into heaps and should be opened within twenty-four hours.

The opening is done in a variety of ways, but the practice followed in Surinam would be an excellent one here if experienced labor was not at command. There, with a heavy knife or cutlass (bolo), they cut off the base or stem end of the fruit and thereby expose the column to which the seeds are attached, and then women and children, who free most of the seeds, are able to draw out the entire seed mass intact. It is exceedingly important that the seeds are not wounded, and for that reason it is inexpedient to intrust the more expeditious method of halving the fruit with a sharp knife to any but experienced workmen.

The process of curing that I have seen followed in these islands is simplicity itself. Two jars half filled with water are provided for the cleaners, and as the seeds are detached from the pulp they are sorted and graded on the spot, only those of large, uniform size, well formed and thoroughly ripe, being thrown into one; deformed, small, and imperfectly matured seeds going to the other. In these jars the seeds are allowed to stand in their own juice for a day, then they are taken out, washed in fresh water, dried in the sun from two to four days, according to the weather, and the process from the Filipino standpoint is complete.

Much of the product thus obtained is singularly free from bitterness and of such excellent quality as to be salable at unusually high prices, and at the same time in such good demand that it is with some hesitancy that the process of fermentation is recommended for general use.

But it is also equally certain that localities in these islands will be planted to cacao where all the conditions that help to turn out an unrivaled natural product are by no means assured. For such places, where the rank-growing, more coarse-flavored, and bitter-fruited Forastero may produce exceptionally good crops, it will become incumbent on the planter to adopt some of the many methods of fermentation, whereby he can correct the crudeness of the untreated bean and receive a remunerative price for the "processed" or ameliorated product.

Undoubtedly the Strickland method, or some modification of it, is the best, and is now in general use on all considerable estates where the harvest is 200 piculs or upward per annum, and its use probably assures a more uniform product than any of the ruder processes in common use by small proprietors.

But it must not be forgotten that the present planters in the Philippines are all small proprietors, and that until such time as the maturing of large plantations calls for the more elaborate apparatus of the Strickland pattern, some practice whereby the inferior crude bean may be economically and quickly converted into a marketable product can not be avoided. As simple and efficacious as any is that largely pursued in some parts of Venezuela, where is produced the famous Caracas cacao.

The beans and pulp are thrown into wooden vats that are pierced with holes sufficient to permit of the escape of the juice, for which twenty-four hours suffices. The vat is then exposed to the sun for five or six hours, and the beans, while still hot, are taken out, thrown into large heaps, and covered with blankets.

The next day they are returned to the box, subjected to a strong sun heat, and again returned to the heap. This operation is repeated for several days, until the beans, by their bright chocolate color and suppleness, indicate that they are cured. If, during the period of fermentation, rain is threatened or occurs, the beans are shoveled, still hot, into bags and retained there until they can once more be exposed to the sun. Before the final bagging they are carefully hand rubbed in order to remove the adherent gums and fibrous matters that did not pass off in the primary fermentation.

In Ceylon, immediately after the beans have been fermented they are washed, and the universally high prices obtained by the Ceylon planters make it desirable to reproduce here a brief résumé of their method. The fermentation is carried on under sheds, and the beans are heaped up in beds of 60 cm. to 1 meter in thickness upon a platform of parallel joists arranged to permit of the escape of the juices. This platform is elevated from the ground and the whole heap is covered with sacks or matting. The fermentation takes from five to seven days, according to the heat of the atmosphere and the size of the heap, and whenever the temperature rises above 40° the mass is carefully turned over with wooden shovels.

Immediately after the fermentation is completed the Ceylon planter passes the mass through repeated washings, and nothing remains but to dry the seed. This in Ceylon is very extensively done, in dryers of different kinds, some patterned after the American fruit dryer, some in slowly rotating cylinders through the axis of which a powerful blast of hot air is driven.

The process of washing unquestionably diminishes somewhat the weight of the cured bean; for that reason the practice is not generally followed in other countries, but in the case of the Ceylon product it is one of the contributing factors to the high prices obtained.

ENEMIES AND DISEASES.

Monkeys, rats, and parrots are here and in all tropical countries the subject of much complaint, and if the plantation is remote from towns or in the forest, their depredations can only be held in check by the constant presence of well-armed hunter or watchman. Of the more serious enemies with which we have to deal, pernicious insects and in particular those that attack the wood of the tree, everything has yet to be learned.

Mr. Charles N. Banks, an accomplished entomologist, now stationed at Maao, Occidental Negros, is making a close study of the life history of the insect enemies of cacao, and through his researches it is hoped that much light will be thrown upon the whole subject and that ways will be devised to overcome and prevent the depredations of these insect pests. The most formidable insect that has so far been encountered is a beetle, which pierces and deposits its eggs within the bark. When the worm hatches, it enters the wood and traverses it longitudinally until it is ready to assume the mature or beetle state, when it comes to the surface and makes its escape. These worms will frequently riddle an entire branch and even enter the trunk. The apertures that the beetle makes for the laying of its eggs are so small—more minute than the head of a pin—that discovery and probing for the worm with a fine wire is not as fruitful of results as has been claimed.

Of one thing, however, we are positively assured, i. e., that the epoch of ripening of the cacao fruit is the time when its powerful fragrance serves to attract the greatest number of these beetles and many other noxious insects to the grove. This, too, is the time when the most constant and abundant supply of labor is on the plantation and when vast numbers of these insects can be caught and destroyed. The building of small fires at night in the groves, as commonly practiced here and in many tropical countries, is attended with some benefits. Lately, in India, this remedy has been subject to an improvement that gives promise of results which will in time minimize the ravages of insect pests. It is in placing powerful acetylene lights over broad, shallow vats of water overlaid with mineral oil or petroleum. Some of these lamps now made under recent patents yield a light of dazzling brilliancy, and if well distributed would doubtless lure millions of insects to their death. The cheap cost of the fuel also makes the remedy available for trial by every planter.

There is a small hemipterous insect which stings the fruit when about two-thirds grown, and deposits its eggs within. For this class of insects M. A. Tonduz, who has issued publications on the diseases of cacao in Venezuela, recommends washing the fruit with salt water, and against the attacks of beetles in general by painting the tree stem and branches with Bordeaux mixture, or with the vassiliére insecticide, of which the basis is a combination of whale-oil soap and petroleum suspended in lime wash. There can be no possible virtue in the former, except as a preventive against possible fungous diseases; of the sanitive value of the latter we can also afford to be skeptical, as the mechanical sealing of the borer's holes, and thereby cutting off the air supply, would only result in driving the worm sooner to the surface. The odor of petroleum and particularly of whale-oil soap is so repellant, however, to most insects that its prophylactic virtues would undoubtedly be great.

The Philippine Islands appear to be so far singularly exempt from the very many cryptogamic or fungous diseases, blights, mildews, rusts, and cankers that have played havoc with cacao growing in many countries. That we should enjoy continued immunity will depend greatly upon securing seeds or young plants only from non-infested districts or from reputable dealers, who will carefully disinfect any shipments, and to supplement this by a close microscopical examination upon arrival and the immediate burning of any suspected shipments.

Another general precaution that will be taken by every planter who aims to maintain the best condition in his orchard is the gathering and burning of all prunings or trimmings from the orchard, whether they are diseased or not. Decaying wood of any kind is a field for special activity for insect life and fungous growth, and the sooner it is destroyed the better.

On this account it is customary in some countries to remove the fruit pods from the field. But unless diseased, or unless they are to be returned after the harvest, they should be buried upon the land for their manurial value.

MANURING.

There are few cultivated crops that make less drain upon soil fertility than cacao, and few drafts upon the land are so easily and inexpensively returned. From an examination made of detailed analyses by many authors and covering many regions, it may be broadly stated that an average crop of cacao in the most-favored districts is about 9 piculs per hectare, and that of the three all-important elements of nitrogen, phosphoric acid, and potash, a total of slightly more than 4.2 kilograms is removed in each picul of cured seeds harvested. These 37 kilos of plant food that are annually taken from each hectare may be roughly subdivided as follows: 18 kilos of nitrogen, 10 kilos of potash, 9 kilos of phosphoric acid.

On this basis, after the plantation is in full bearing, we would have to make good with standard fertilizers each year for each hectare about 220 kilos of nitrate of soda, or, if the plantation was shaded with leguminous trees, only one-half that amount, or 110 kilos. Of potash salts, say the sulphate, only one-half that amount, or 55 kilos, if the plantation was unshaded. If, however, it was shaded, as the leguminous trees are all heavy feeders of potash, we would have to double the amount and use 110 kilos.

In any case, as fixed nitrogen always represents a cost quite double that of potash, from an economical standpoint the planter is still the gainer who supplies potash to the shade trees. There still remains phosphoric acid, which, in the form of the best superphosphate of lime, would require 55 kilos for unshaded orchards, and about 70 if dap-dap, Pionciana, or any leguminous tree was grown in the orchard. These three ingredients may be thoroughly incorporated and used as a top dressing and lightly harrowed in about each tree.

If the commercial nitrates can not be readily obtained, then recourse must be had to the sparing use of farm manures. Until the bearing age these may be used freely, but after that with caution and discrimination. Although I have seen trees here that have been bearing continuously for twenty-two years, I have been unable to find so much as one that to the knowledge of the oldest resident has ever been fertilized in any way, yet, notwithstanding our lack of knowledge of local conditions, it seems perfectly safe to predicate that liberal manuring with stable manure or highly ammoniated fertilizers would insure a rank, succulent growth that is always prejudicial to the best and heaviest fruit production. In this I am opposed to Professor Hart,[a] who seems to think that stable manures are those only that may be used with a free hand.

We have many safe ways of applying nitrogen through the medium of various catch crops of pulse or beans, with the certainty that we can never overload the soil with more than the adjacent tree roots can take up and thoroughly assimilate. When the time comes that the orchard so shades the ground that crops can no longer be grown between the rows, then, in preference to stable manures I would recommend cottonseed cake or "poonac," the latter being always obtainable in this archipelago.

While the most desirable form in which potash can be applied is in the form of the sulphate, excellent results have been had with the use of Kainit or Stassfurth salts, and as a still more available substitute, wood ashes is suggested. When forest lands are near, the underbrush may be cut and burned in a clearing or wherever it may be done without detriment to the standing timber and the ashes scattered in the orchard before they have been leached by rains. The remaining essential of phosphoric acid in the form of superphosphates will for some years to come necessarily be the subject of direct importation. In the cheap form of phosphate slag it is reported to have been used with great success in both Grenada and British Guiana, and would be well worthy of trial here.

Lands very rich in humus, as some of our forest valleys are, undoubtedly carry ample nitrogenous elements of fertility to maintain the trees at a high standard of growth for many years, but provision is indispensable for a regular supply of potash and phosphoric acid as soon as the trees come into heavy bearing. It is to them and not to the nitrogen that we look for the formation of strong, stocky, well-ripened wood capable of fruit bearing and for fruit that shall be sound, highly flavored, and well matured.

The bearing life of such a tree will surely be healthfully prolonged for many years beyond one constantly driven with highly stimulating foods, and in the end amply repay the grower for the vigilance, toil, and original expenditure of money necessary to maintaining a well-grown and well-appointed cacao plantation.

SUPPLEMENTAL NOTES.

New varieties.—Cacao is exclusively grown from seed, and it is only by careful selection of the most valuable trees that the planter can hope to make the most profitable renewals or additions to his plantations. It is by this means that many excellent sorts are now in cultivation in different regions that have continued to vary from the three original, common forms of *Theobroma cacao* until now it is a matter of some difficulty to differentiate them.

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[a] "Cacao," p. 16.

Residence.—The conditions for living in the Philippines offer peculiar, it may be said unexampled, advantages to the planter of cacao. The climate as a whole is remarkably salubrious, and sites are to be found nearly everywhere for the estate buildings, sufficiently elevated to obviate the necessity of living near stagnant waters. Malarial fevers are relatively few, predacious animals unknown, and insects and reptiles prejudicial to human life or health extraordinarily few in number. In contrast to this we need only call attention to the entire Caribbean coast of South America, where the climate and soil conditions are such that the cacao comes to a superlative degree of perfection, and yet the limits of its further extension have probably been reached by the insuperable barrier of a climate so insalubrious that the Caucasian's life is one endless conflict with disease, and when not engaged in active combat with some form of malarial poisoning his energies are concentrated upon battle with the various insect or animal pests that make life a burden in such regions.

Nonresidence upon a cacao plantation is an equivalent term for ultimate failure. Every operation demands the exercise of the observant eye and the directing hand of a master, but there is no field of horticultural effort that offers more assured reward, or that will more richly repay close study and the application of methods wrought out as the sequence of those studies.

ESTIMATED COST AND REVENUES DERIVED FROM A CACAO PLANTATION.

Estimates of expenses in establishing a cacao farm in the Visayas and profits after the fifth year. The size of the farm selected is 16 hectares, the amount of land prescribed by Congress of a single public land entry. The cost of procuring such a tract of land is as yet undetermined and can not be reckoned in the following tables. The prices of the crop are estimated at 48 cents per kilo, which is the current price for the best grades of cacao in the world's markets. The yield per tree is given as 2 catties, or 1.25 kilos, a fair and conservative estimate for a good tree, with little or no cultivation. The prices for unskilled labor are 25 per cent in advance of the farm hand in the Visayan Islands. No provision is made for management or supervision, as the owner will, it is assumed, act as manager.

Charges to capital account are given for the second, third, and fourth year, but no current expenses are given, for other crops are to defray operating expenses until the cacao trees begin to bear. No estimate of residence is given. All accounts are in United States currency.

Estimates of expenses in establishing a cacao farm.

FIRST YEAR.

Capital account:		
Clearing of average brush and timber land, at $15 per hectare	$340.00	
Four carabaos, plows, harrows, cultivators, carts, etc	550.00	
Breaking and preparing land, at $5 per hectare	80.00	
Opening main drainage canals, at $6 per hectare	96.00	
Tool house and storeroom	200.00	
Purchase and planting 10,000 abaca stools, at 2 cents each	200.00	
Seed purchase, rearing and planting 12,000 cacao, at 3 cents each	360.00	
Contingent and incidental	174.00	
Total		$2,000.00

SECOND YEAR.

Interest on investment	$200.00	
Depreciation on tools, buildings, and animals (20 per cent of cost)	150.00	
Total		350.00

THIRD YEAR.

Interest on investment	$200.00	
Depreciation as above	150.00	
Total		350.00

FOURTH YEAR.

Interest on investment	$200.00	
Depreciation as above	150.00	
Building of drying house and sweat boxes, capacity 20,000 kilos	450.00	
		$800.00
Total capital investment		3,500.00

FIFTH YEAR.

Income account:		
From 11,680 cacao trees, 300 grams cacao each, equals 3,500 kilos, at 48 cents		1,680.00
Expense account:		
Fixed interest and depreciation charges on investment of $3,500	$350.00	
Taxes 1½ per cent on a one-third valuation basis of $250 per hectare	60.00	
Cultivating, pruning, etc., at $5.50 per hectare	88.00	
Fertilizing, at $6 per hectare	96.00	
Harvesting, curing, packing 3,500 kilos cacao, at 10 cents per kilo	350.00	
Contingent	86.00	
		1,030.00
Credit balance		650.00

SIXTH YEAR.

Income account:		
From 11,680 cacao trees, at 500 grams cacao each, equals 5,840 kilos, at 48 cents		2,803.20
Expense account:		
Fixed interest and depreciation charges as above	$350.00	
Taxes as above	60.00	
Cultivating, etc., as above	88.00	
Fertilizing, at $8 per hectare	128.00	
Harvesting, etc., 5,840 kilos cacao, at 10 cents per kilo	584.00	
Contingent	93.20	
		1,303.20
Credit balance		1,500.00

SEVENTH YEAR.

Income account:		
From 11,680 cacao trees, at 750 grams cacao each, equals 8,760 kilos, at 48 cents		4,204.80
Expense account:		
Fixed interest charges as above	$350.00	
Taxes as above	60.00	
Cultivating, etc., as above	88.00	
Fertilizing, at $10 per hectare	160.00	
Harvest, etc., of 8,760 kilos of cacao, at 10 cents per kilo	876.00	
Contingent	170.80	
		1,704.80
Credit balance		2,500.00

EIGHTH YEAR.

Income account:		
From 11,680 cacao trees, at 1 kilo cacao each, equals 11,680 kilos, at 48 cents		5,606.40
Expense account:		
Fixed interest charges as above	$350.00	
Taxes as above	60.00	
Cultivating, etc., as above	88.00	
Fertilizing, at $12.50 per hectare	200.00	
Harvest, etc., 11,680 kilos of cacao, at 10 cents per kilo	1,168.00	
Contingent	240.40	
		2,106.40
Credit balance		3,500.00

NINTH YEAR.

Income account:		
From 11,680 trees, at 2 ''catties'' or 1.25 kilos cacao each, equals 14,600 kilos, at 48 cents		$7,008.00
Expense account:		
Fixed interest charges as above	$350.00	
Taxes at 1½ per cent on a one-third valuation of $500 per hectare	120.00	
Cultivation and pruning as above	88.00	
Fertilizing, at $15 per hectare	240.00	
Harvesting, etc., of 14,600 kilos of cacao, at 10 cents per kilo	1,460.00	
Contingent	250.00	
		2,508.00
Credit balance		4,500.00

In the tenth year there should be no increase in taxes or fertilizers, and a slight increase in yield, sufficient to bring the net profits of the estate to the approximate amount of $5,000. This would amount to a dividend of rather more than $312 per hectare, or its equivalent of about $126 per acre.

These tables further show original capitalization cost of nearly $90 per acre, and from the ninth year annual operating expenses of rather more than $60 per acre.

It should be stated, however, that the operating expenses are based upon a systematic and scientific management of the estate; while the returns or income are based upon revenue from trees that are at the disadvantage of being without culture of any kind, and, while I am of the opinion that the original cost per acre of the plantation nor its current operating expenses may be much reduced below the figures given, I feel that there is a reasonable certainty that the crop product may be materially increased beyond the limit of two ''catties.''

In Camerouns, Doctor Preuss, a close and well-trained observer, gives the mean annual yield of trees of full-bearing age at 4.4 pounds.

Mr. Rousselot places the yield on the French Kongo at the same figure. In the Caroline Islands it reaches 5 pounds and in Surinam, according to M. Nichols, the average at maturity is 6½ pounds. In Mindanao I have been told, but do not vouch for the report, of more than 10 ''catties'' taken in one year from a single tree; and as there are well-authenticated instances of record of single trees having yielded as much as 30 pounds I am not prepared to altogether discredit the Mindanao story.

The difference, however, between good returns and enormous profits arising from cacao growing in the Philippines will be determined by the amount of knowledge, experience, and energy that the planter is capable of bringing to bear upon the culture in question.

AGRICULTURAL BUREAU.

(Farmers' Bulletin No. 3.)

MODERN RICE CULTURE.

By Wilfred J. Boudreau.

LETTER OF TRANSMITTAL.

Manila, P. I., *August 15, 1902.*

Sir: I have the honor to transmit herewith for publication as a bulletin of this bureau a manuscript on modern methods of rice culture.

Rice as an article of food occupies the same position in the Philippines that wheat does in America and Europe, and it is eminently proper, therefore, that its culture should receive considerable attention from this bureau. Especially is this the case when we take into consideration the fact that 375,784,891 pounds are annually imported into these islands, representing an aggregate of $4,178,912 gold, and that this sum of money could easily be kept in this country for its industrial development if rational, up-to-date systems of rice culture were introduced.

Respectfully,

Wilfred J. Boudreau,
In Charge of Rice and Cane Investigations.

F. Lamson-Scribner,
Chief of Bureau of Agriculture.

INTRODUCTION.

The cultivation of rice in the Philippines is in many respects similar to that practiced in China, Japan, India, and other oriental countries. It is true that plows are more generally used here than in these latter countries, but they are such primitive affairs and the work performed with them is so unsatisfactory that, economically considered, they are of very little more value than the mattock and the spade. The main operations, however, such as preparing the seed beds, transplanting, puddling the soil, and harvesting the crop all conform to the oriental type and are such as characterize all countries where labor is cheap.

So cheap is labor in some of these countries that a man's wages for one year are $15 gold and board. Consequently a farmer has very little inducement to invest in money in labor-saving machinery, and it is questionable whether it would be advisable or even practicable, to make a radical change in the rice culture of China and Japan. Most of the lands suitable for rice growing are already utilized for that purpose, and so dense are the populations that it would be next to impossible in these countries to produce sufficient food to maintain the present inhabitants and the necessary draft animals if modern farm machinery were introduced. Besides, the use of labor-saving machinery would result in throwing a large portion of the people out of employment and thus entail widespread suffering and hardship. In addition to this it may be said that the fields are not properly laid out for the use of modern agricul-

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Footnote.—The following illustrations accompanying this report are on file in the War Department:

Fig. 1, a light steel-beam plow; fig. 2, a heavy wooden-beam plow; fig. 3, a two-furrow gang plow; fig. 4, a three-furrow gang plow; fig. 5, a disk harrow; fig. 6, a spring-tooth harrow; fig. 7, a smoothing harrow; fig. 8, a rice drill; fig. 9, an ordinary scoop or road scraper; fig. 10, road scraper in operation; fig. 11, rice sickle; fig. 12, cradle for harvesting rice or other grain; fig. 13, reaper and binder for harvesting rice; fig. 14, harvesting rice in Louisiana; fig, 15, thrasher; fig. 16, traction engine.

tural implements. The majority of the fields are small, irregular strips of land, divided from one another by levees, which have been constructed at great cost of time and labor, and before gang plows, disk choppers, and twine binders could be introduced it would be necessary to throw these levees down.

In the Philippines no such obstacles exist. The population is comparatively sparse. In a territory equal in extent to the whole of New England and the State of New York there are only some six or eight million people. The consumption of rice greatly exceeds the production, notwithstanding the fact that there are extensive areas distributed throughout the archipelago which are admirably adapted to the growing of rice. Indeed, the natural conditions for the production of this crop are so favorable that it would not be surprising to see the Philippines become, within the next ten years, one of the leading rice-producing countries of the world.

It was stated above that no obstacles exist to the introduction of a new system of rice culture in this country. We may go further and say that it is absolutely necessary that it should be done. Ever since the occupation of these islands by the American Army four years ago the price of labor has steadily increased, and as American customs are gradually introduced we may look forward to a further advance. It is needless to say that every industry will be profoundly affected by this, and the rice industry will be one of the first to feel its influence, for it is a crop which must be grown cheaply in order to be profitable. To pursue the same system of cultivation as in China, however, and to have to pay three and four times as much for labor is out of the question. Hence the rice farmer will have to adapt himself to the new condition if he wishes to compete successfully with foreign rice, and it is with the veiw of outlining a new system that this bulletin is published.

Of course it will take time before the methods indicated can be carried out in the remote provinces. There are difficulties to be overcome, chief among which is the question of draft animals, but that a revolution in rice culture is inevitable there can be no doubt, and the sooner it is realized the sooner a beginning will be made.

In concluding these preliminary remarks, a few words might be said with advantage in regard to cheap labor and labor-saving machinery. Cheap labor is by no means the cheapest article on the market. In support of this statement the following figures are submitted: The labor of a Filipino in the rice fields of the Philippines has been estimated at $20 gold and board per annum. The amount of land which he can cultivate is 2½ acres, yielding 1,500 pounds of paddy. In Texas or Louisiana, on the other hand, a laborer receives $200 gold and board, but he cultivates 80 acres of land, and the cultivation is so superior that with irrigation water alone he produces 160,000 pounds of paddy. In short, he receives ten times the wages, but he produces one hundred times more rice than the Filipino laborer.

It is not claimed that such results can be obtained in the Philippines. This is a question which can only be definitely settled in the field, and as soon as possible practical work will be undertaken to determine exactly to what extent local conditions may modify the results obtained in Louisiana and Texas.

SOILS SUITABLE FOR RICE GROWING.

Any fairly fertile soil that has sufficient clay to retain the moisture will grow rice. Generally speaking, lands which will produce cane, cotton, and corn will produce rice, and, where a system of rotation is followed in the cultivation of these crops, rice can be made a part of the system with advantage. It does not follow, however, that cotton, cane, or corn will grow well where rice will thrive. On the contrary, the best rice lands are those which have an impervious substratum of clay, and, ordinarily, such lands are not very well adapted to sugar, corn, and cotton culture.

In selecting a site for a rice farm—we shall speak of lowland rice only for the present—rolling lands should be avoided, as it is impossible to flood such lands economically. The greatest expense in the cultivation of rice is the one connected with the construction of levees, and the amount of leveeing depends altogether upon the topography of the country. Perfectly level land presents ideal conditions for rice culture, because the "cuts" may be made as extensive as one may desire, the limit being the amount which can be planted in two or three days. A larger field would be impracticable, because the rice would not all germinate at the same time. The advantages of large cuts over small ones can not be exaggerated. Not only is the expense of leveeing very much reduced, but the amount of unoccupied land is not so great, and there is not so much likelihood of the fields becoming infested with weeds, as these levees are veritable weed nurseries. Furthermore, if the nature of the soil permits, twine binders can be more profitably employed than in small cuts.

When the land slopes, on the other hand, the size of cuts depends altogether upon the grade. Rice will not thrive well in more than 8 or 10 inches of water, and if the land has a slope of, let us say, 3 inches to the acre it will be necessary to construct the levees every 2 acres, since 4 inches of water on the elevated end of the field will flood the rice to a depth of 10 inches at the lower end. Therefore the more the land slopes the nearer the levees have to be, and finally a limit is reached when gang plows and other implements can not be used, as every turn at the end of the cut represents a loss of time and money.

There are two other factors which should be considered in selecting a site for a rice farm, and these are irrigation and drainage. No one can undertake the cultivation of rice and afford to ignore them, and they are of such primary importance that they will be discussed under a separate heading.

PREPARATION OF THE SOIL.

The breaking of the land should begin as long before planting as possible, for, inasmuch as water remains on the soil during the whole period of growth of the rice crop, the microorganisms which are responsible for nitrification whereby soluble nitrates are provided for the plant remain dormant, if they be not totally destroyed, for lack of oxygen, and for this reason the land should be plowed as soon as possible after the first crop is gathered in order to give the soil a thorough airing.

The breaking up of the soil can be effected with any ordinary steel plow, but where it is desired to grow rice on a large scale gang plows are more economical. There are different makes of these implements, but they are all constructed on the same principle and consist essentially of a broad plow or a number of smaller ones hung on a frame and wheels. With one of these and three or four mules a man can do five and six times the work in one day that he could do with an ordinary plow, and three gang plows are all that are needed to plow up a 500-acre farm.

The depth to which the soil should be plowed depends upon local conditions, and no general rule can be given that would be applicable to every case. For some soils plowing 5 or 6 inches deep gives the best results, whereas in other cases 3 or 4 inches are reported to give as satisfactory crops as deep plowing. In all old rice fields, however, the probabilities are that an artificial hardpan exists as a result of the shallow plowing which is practiced, and in such cases the land should be plowed deeply the first year, so as to permit of better underdrainage and in order that the roots of the plant may penetrate the soil more deeply in quest of foot.

After the land is broken up it should be pulverized with a disk chopper and smoothing harrow to prevent the land from baking and to put it in such a condition that it will retain moisture. If the land is not too heavy the disk chopper will not be necessary, any heavy harrow being sufficient

PLANTING.

There are two ways in which rice may be planted. It may either be sown broadcast, or it may be planted with a drill. Both methods are extensively used, but the best authorities advocate the use of the drill. Rice planted with the drill, it is claimed, will germinate more uniformly, and this is an important point in the cultivation of rice. Besides, when the land is grassy it is an easy matter to hoe and weed the rice if it has been drilled, whereas if it were sown broadcast the operations would be very much more difficult.

The seed may be sown to the depth of 2 inches in May and June and at the rate of 2 bushels to the acre. When the soil is very dry a roller should be dragged over the field so as to compact the ground, thereby increasing the capillary power of the soil and thus causing moisture to rise from below. Should water be available, however, a better plan is to apply a sufficient quantity of it to saturate the soil and to pass a light harrow over the field as soon as it is sufficiently dry.

DRAINAGE.

Although rice is a water plant, good drainage is as essential in its cultivation as it is in that of any other crop. If the land will not admit of thorough drainage, it will be impossible to prepare the ground properly, and in consequence the stand will be poor and the yield of the crop very much diminished. It is generally believed, too, that when rice approaches maturity the water should be withdrawn from the land so as to permit of the formation of a good heavy head. Rice can unquestionably ripen in water, but the character of the seed is very much affected for the worse thereby, and in milling such a crop it will not give as good an article of commerce as it would have given if the water had been withdrawn at the proper time.

It is in the harvesting of the crop, however, that drainage is most important. It matters not whether the rice is harvested with a reaper and binder or a sickle, the field should be dry, so as to permit of the shocking of the rice in the field where it falls. So far as shocking rice in mud and water is concerned, that is absolutely out of the question, and to have to carry it to the levees, as is now done, is too slow and expensive a process.

IRRIGATION.

Of equal importance with drainage is the subject of irrigation. Unfortunately, the conditions are so favorable for the growth of rice during the rainy season that very little has been done to utilize the water supply by the large number of streams which traverse the country in every direction. Usually the rain water is sufficient to mature one crop, and the river water, which contains a large amount of silt and soluble plant food, has been permitted to flow uninterrupted to the sea.

The western farmer and the sugar planter of the Hawaiian Islands know what a difference irrigation makes in the yield of their crops, but such results are not as remarkable as those that are obtained in applying irrigation water to rice lands. In certain portions of Louisiana and Texas rice has been grown on some lands for a number of years, and they continue to yield nearly as much rice now as they did the first year they were cultivated, although the only fertilizer applied during the whole of this time has been irrigation water. Even here in the Philippines, where the yield of rice per acre is in the neighborhood of 600 pounds, lands have been made to produce 2,000 pounds with the help of irrigation.

We need not go far to find the reason for this. It is a well-recognized fact that no matter how rich in plant food a soil may be, the plant unaided can not assimilate any of it. By a wise provision of nature most of the plant food in the soil is stored in the form of insoluble compounds, and as such they can not be leached out by rain water. Before the rootlets of the plant can absorb this plant food it is necessary that it should be in soluble form, and this chemical operation is performed mostly by low forms of plant life, commonly known as bacteria. As was noted above, however, these special bacteria will thrive only in the presence of oxygen, and as rice lands are under water for a great part of the time the work of the bacteria is suspended, and consequently the supply of soluble food in the soil ceases to increase under these conditions, and, unless the young plant is supplied with food from some other source, it can not be expected to reach perfection.

Irrigation supplies this extraneous food, and although there may be but little fertilizers in the water, such an immense quantity of water is evaporated during the growth of the rice that a large amount of nitrogen, phosphoric acid, and potash are given up to the plant.

Another reason why irrigation should be employed in preference to rain water is because its temperature more nearly approaches that of the ground than does the temperature of rain water, and this is a point recognized to be of a good deal of importance.

Finally, by means of irrigation water, two crops of rice could be grown on the same land in the course of a year and the yield of the land thereby doubled.

DITCHES AND LEVEES.

The most economical way of digging ditches and constructing levees is to make use of good strong plows, scoops, and grading machines. With a plow, a scoop, and a pair of mules a man can do as much work in a day as he could do in two weeks with a spade. Where the operations are to be conducted on a large scale and the planter can afford to purchase a road machine, it would be well for him to do so, as it is very useful in making the main channel or canal for conducting the water from the water supply to the field.

In building the levees around the different cuts the aim should be to make them broad and sloping rather than steep and narrow. The reason for this is that the former levees facilitate the use of agricultural implements.

A good plan is to plow a ridge 6 or 8 feet wide, where the levee is to stand, and harrow down. As soon as it rains, plow up again, always throwing the dirt to the center, and continue this process until the bank has attained a sufficient height, usually 18 to 20 inches.

The question of utilizing the water supply, constructing reservoirs, dams, lifting water from rivers, etc., is too large a one for present discussion, and it will be made the subject of future bulletins.

TREATMENT OF THE CROP.

Should no irrigation water be available, as soon as the rice is 4 or 5 inches tall all the drains in the levees are to be closed so as to retain the rain water, and if the season is favorable sufficient water will be caught to keep the grass smothered and to mature the rice. In no case should the water completely cover the rice.

Where irrigation is practiced, enough water to saturate the soil may be applied when the rice is 2 or 3 inches tall, provided it stands in need of it. This will give the crop an early start, and this is important, for in the struggle for existence with the grass, rapid growth in the rice is all important.

In the course of three or four weeks the rice will be 7 or 8 inches tall, and water may be turned on to the depth of 4 inches. As the rice grows, more water should be added until it stands about 8 inches deep.

When possible, it is well to keep the water in circulation, as it prevents the growth of certain grasses which thrive in stagnant water. This can be done by permitting a certain amount of water to escape at the lower end of the field and supplying a corresponding amount at the upper end.

Ordinarily no further attention is necessary until the crop is ready to be harvested, but should weeds spring up among the rice plants they will have to be pulled, and occasionally the rice becomes so grassy that all growth ceases and the plant assumes a yellow color. In such a case there are only two remedies; either more water must be admitted so as to completely submerge the grass, or, if the rice is too small to permit of such a treatment, the water must be completely withdrawn and the field mowed down. The rice, by virtue of the rapidity with which it grows, when mown down will soon outstrip the grass, and by flooding at the proper time the crop can be saved.

There should very seldom be an occasion for such heroic treatment, however, on a plantation which has sufficient irrigation water, because, with a proper system of control, the grass can nearly always be completely covered with water and thus smothered out.

Within ten or twelve days before the grain is ripe the water should be completely drained off. The time to draw off the water can be easily ascertained by noticing the color and position of the heads and the consistence of the grain. As the rice begins to ripen the heads assume a drooping position and they take on a pale straw color. As above noted, the grain, too, is a good guide, for on breaking it it will be found to be of the consistency of dough.

HARVESTING.

The harvesting of the rice crop is an operation which can be performed either with the sickle, the cradle, or the reaper and binder. Whenever it is possible to use a reaper and binder one of the greatest expenses in rice growing is reduced to a minimum. With the use of this machine and six mules a man can reap from 8 to 12 acres a day. Unfortunately, it is not every field which can be reaped with a twine binder, and its use on any given tract of land is determined by three conditions: First, the land must be susceptible of thorough drainage; next, an impervious substratum of clay must underlay the land; and finally, the harvesting season must be moderately dry. Without these three conditions the twine binder is impracticable. The machine is a heavy one, and unless the ground is dry it will sink so deeply as to be very heavy to pull. In addition to this the drive wheel becomes so clogged with mud and bits of straw that it slides along the ground instead of turning, and, in consequence, the knives are stopped.

Whether the physical condition of the soil will permit of the general introduction of this valuable machine in the rice fields of the Philippines is an unsettled question. The bureau has a reaper and binder among its collection of agricultural machinery, and a thorough test of its efficiency will be made as soon as practicable.

Where it is not possible to make use of the twine binder, sickles and cradles are employed, the rice being cut with about 2 feet of straw and tied in bundles about 6 inches in diameter. Some 25 or 30 of these bundles are shocked together and a few bundles placed on top of the shocks to protect the grain from too much sun and from the depredations of birds.

THRESHING.

The machines employed in threshing rice are practically the same as those used in in the wheat fields of the western United States. Their capacities range from 40,000 to 90,000 pounds of paddy per day, and it can readily be seen that a small farmer does not stand in need of a thresher for his exclusive use. Not only this, but in the United States the cost of a threshing machine, including engine, is $1,200 gold, and it is only persons of some means, even in America, who can purchase them.

In order to overcome this difficulty it is customary for some person to buy a machine and charge the farmers so much per sack for threshing their rice. The threshers are portable and are hauled from place to place by the traction engines, which furnish the power for operating the threshers. In case a farmer has only fifty or a hundred sacks, however, he has to haul the rice in the straw to the machine, because it is not profitable to move the thresher unless it can do a day's work in one place.

Rice threshing is a very profitable business in the United States. As much as $75 net per day is earned by some threshers, and although the rice industry may not have recovered sufficiently from the recent troubles to warrant their introduction in the provinces just now, we can see no reason why threshers situated at central points should not prove profitable in the near future.

FERTILIZERS.

In determining the kind of fertilizers and the quantity which should be applied to a soil in order to grow any given crop, one of the most essential things to know is the composition of the plant, for by knowing this we get a good idea of the fertilizing materials which the crop extracts from the soil, and thus we are able to supply this drain judiciously.

The average analysis of the rice plant shows that every 100 pounds of the grain contains 1.19 pounds of nitrogen, 0.321 pound of phosphoric acid, and 0.16 pound of potash; and 100 pounds of the straw contains 0.756 pound of nitrogen, 0.26 pound of phosphoric acid, and 0.42 pound of potash. Therefore, an acre of land which produces 2,000 pounds of paddy and 4,000 pounds of straw will lose a total of:—

	Nitrogen.	Phosphoric acid.	Potash.
2,000 pounds paddy	23.80	6.42	3.20
4,000 pounds straw	30.24	10.40	16.80
Total	54.04	16.82	20.00

With these figures we should be able to form a fair estimate of the amount of fertilizer to apply to rice land. But from this a deduction in the amount of nitrogen to be applied may be made for the nitrogen which is brought to the soil in rain water, and where irrigation is practiced a deduction may be made not only in the amount of nitrogen but also in the phosphoric acid and potash. What this amount is it will be impossible to say until chemical analyses are made of the waters of the principal rivers and streams of these islands, and it is to be hoped that data in reference to this matter will be available in the near future.

Just in what form to apply fertilizers to rice lands is another question to be considered. Rice is so peculiar in its habits of growth that the matter of fertilizing it is very much more complicated than is the case of ordinary crops. As was noted above, nitrification is an impossibility in a field of growing rice which is under water; consequently, the application of any but soluble fertilizers will give no immediate results, and such soluble fertilizers as sodium nitrate and water-soluble phosphates are so high priced that it is questionable whether they will ever be extensively used. The only practical scheme that can be suggested just now is that the land be fertilized and fallowed or that a system of rotation such as is practiced in Java be introduced. By rotating the crop with corn, leguminous plants, cane, and cotton, not only is it possible to fertilize the land and increase the subsequent yield, but noxious weeds can be either totally destroyed or at least greatly decimated.

VARIETIES.

The number of distinct varieties of rice is variously estimated at from 1,400 to 3,000. Whether there are even so many as 1,400 or whether the same variety bears different names in different localities is not known. It is very well recognized, nevertheless, that varieties play an important part in the color, shape, size, taste, yield, and maturity of the grain, and too much care and judgment can not be exercised in selecting seed. Many of the good effects of efficient cultivation will be lost if an inferior variety of seed is planted, and there are certain varieties of rice which are so poorly adapted to the milling process that great financial losses are incurred in cultivating them.

In certain parts of the United States where Honduras rice was formerly exclusively grown this loss was so great that seed rice was imported from Japan with the view of obviating this defect in the Honduras, and the Japanese rice gave such satisfactory results, not only in the greater resisting power which it possessed in withstanding the breakage of the mills, but also in the yield per acre, that larger quantities were imported the following year, and now the Japanese rice is cultivated very extensively.

Some of this Japan rice has lately been imported by the insular bureau of agriculture and is now being distributed to the farmers of the islands.

UPLAND OR MOUNTAIN RICE.

This rice, as its name implies, is cultivated where the land is too rolling to practice flooding. Large amounts of it are raised in these islands, and in certain districts where the valleys are narrow and level lands are scarce mountain rice constitutes the principal article of food of the natives.

In regard to its cultivation, very little need be said more than has already been stated in regard to lowland rice. The cultivation and harvesting of the crop are practically the same as for flooded rice, excepting that no provision need be made for leveeing. The only difference between the cultivation of the upland and the lowland rice lies in the fact that the former has to be frequently hoed and weeded, because there is not water on the land to smother the grass.

CONCLUSION.

In conclusion we wish to reiterate that there is no reason why scientific methods of culture and modern agricultural implements should not make the Philippines one of the leading rice countries of the world. It was not many years ago when the rice industry in Louisiana was on the same footing with the rice industry of the Orient and yet such a revolution has been effected in the cultivation of rice in that State within the last fifteen years as has not been accomplished in Chinese rice culture in six thousand years.

APPENDIX.

IMPLEMENTS AND DRAFT ANIMALS REQUIRED TO CULTIVATE A 500-ACRE FARM.

For the information of those readers of this bulletin who may be interested in the matter, the following statement relative to the number of draft animals and kind of machinery required to cultivate a 500-acre rice farm, together with the cost thereof in United States currency, is appended:

	Number.	Cost.
Mules	20	$3,000
12-inch gang plows	3	135
Disk harrows	3	60
Smoothing harrows	3	45
Twine binders for harvesting	3	450
Thrasher and traction engine	1	1,250
Total		4,940

The thrasher can be made to thrash the rice of 1,000 or 1,500 acres, so that if anyone should wish to cultivate that amount of land it would only be necessary to purchase 40 or 60 mules and the proper multiple of machinery stated for a 500-acre farm, exclusive of thrasher.

The gross receipts for the crop of a 500-acre farm will vary in the United States from $15,000 to $20,000 gold, according to the amount of red rice found in the paddy.

BUREAU OF AGRICULTURE.

(Farmers' Bulletin No. 5.)

CULTIVATION OF TOBACCO.

By Clarence W. Dorsey.

LETTER OF TRANSMITTAL.

Bureau of Agriculture,
Manila, P. I., April 22, 1903.

Sir: I have the honor to transmit herewith, for publication as a farmers' bulletin of this bureau, a paper on the cultivation of tobacco. Tobacco occupies a prominent place among the list of exports of the islands, but the quality of the product is inferior to that formerly grown, and the cultivation of the plant does not receive the attention it should. The cultivation of this profitable crop deserves more widespread attention, for the soil and climatic conditions in many parts of the Philippines are favorable for growing tobacco that can successfully compete with the finest grades produced in the world. To raise tobacco of superior quality it is necessary that the greatest care and attention should be taken at every stage of growth of the plant, and the present paper is written with the intention of arousing greater interest in the industry and describing some of the more important features of its cultivation.

Respectfully,

Clarence W. Dorsey, *Soil Physicist.*

Prof. F. Lamson-Scribner,
Chief, Bureau of Agriculture.

INTRODUCTION.

In the present paper an effort will be made to describe briefly the methods employed in modern cultivation of tobacco, to treat of recent successes in growing tobacco under shade in the United States, and also describe the conditions of tobacco culture in Sumatra, with especial reference to the industry in the Philippines.

In the preparation of this paper the bulletins of the United States Department of Agriculture relating to the cultivation of tobacco have been very freely used and much information has been obtained from the gentlemen connected with the leading tobacco companies in Manila.

Philippine tobacco has long been held in high esteem in the Orient, and Manila cigars maintain the same rank in eastern countries that Havana cigars occupy in Europe and America. To-day tobacco stands third among the exports from the Philippines. During the year 1900, according to the Monthly Summary of Commerce and Finance of the United States, 11,743,336 kilos of tobacco, valued at $1,906,436 United States currency, were exported from the islands. Tobacco was introduced into the Philippines shortly after the Spaniards took possession, seed having been brought from Mexico by Spanish missionaries. Little effort was made by the government to restrict or encourage the cultivation of tobacco until 1781, when the cultivation and sale of tobacco was decreed a state monopoly. While this monopoly was in force the natives in the large tobacco districts of Luzon were subjected to great inconveniences and even hardships. Each family was compelled to grow 4,000 plants and deliver the entire crop to the agents of the government. None of the crop could be reserved for the use of the planter, and a fine was imposed when the crop was short. After the crop was harvested the leaves were selected and bought by the government agents, and bundles of inferior leaves were rejected and burned. Native houses were searched for concealed tobacco, and fines and penalties imposed on those who did not comply with all the requirements of the monopoly. Early in the nineteenth century many riots and disturbances arose out of the difficulties in meeting the harsh provisions of the law.

In the Visayan and southern islands the monopoly was not in force, but tobacco raising was not generally practiced until the middle of the nineteenth century. The profits from the monopoly annually amounted to several million pesos, but was finally abolished on December 31, 1882. Since that time the cultivation and manufacture of the crop has been in the hands of private individuals and companies. At the present time the greater part of the tobacco grown in the islands comes from Luzon. The products of Isabela and Cagayan provinces are the most highly esteemed, while considerable quantities are produced in Union and the Ilocos provinces, on the west coast of northern Luzon. Nueva Ecija formerly raised a fair grade of tobacco, but the cultivation has fallen off in late years. The writer saw in Batangas Province many small fields that would aggregate many hundreds of hectares of tobacco. This is largely used for local consumption and is of inferior quality. Tobacco is grown in small quantities in the Visayan and southern islands, the greatest amounts probably being produced in Masbate, Tablas, Panay, Bohol, Leyte, Siquijor, Negros, and Mindanao.

Philippine tobacco is nearly all utilized in the manufacture of cigars and cigarettes, and finds a ready sale in Spain (which consumes more than one-half of the total production), England, Hongkong (where it is shipped to Asiatic ports), and British East India. During the year 1900 these countries bought more than seven-tenths of the entire crop. The agreeable aroma and flavor of the better grades of tobacco grown in the islands have won for it a high place among the fine cigar tobaccos of the world, and for a long time it ranked next to the celebrated Cuban tobacco. When we consider the desirable qualities of Philippine tobacco, with the imperfect cultivation, curing, and fermentation it receives, and the improvements and advances that have been made in other tobacco countries, it becomes at once evident that every care and attention should be given the crop to enable it to regain its former position, if not to make it superior to the finest tobaccos grown in the world.

The markets of the United States offer every inducement for the improvement and spread of the Philippine tobacco industry. This becomes all the more evident when we consider the vast sums of money annually expended by the United Staters for foreign tobacco. During the year ending June 30, 1900, the United States, according to official statistics of the agricultural imports of the United States, paid for Cuban tobacco $7,615,991 United States currency, and $4,569,271 United States currency for Sumatra tobacco. During this same year the Philippines exported to the United States only a few hundreds of dollars' worth of tobacco, or less than one-hundredth of 1 per cent of the tobacco importations of that country. While it may be true that Philippine tobacco may never entirely supplant Cuban and Sumatra tobacco in the United States, there is certainly every inducement to encourage and improve the industry until modern cultural methods have realized to the fullest extent the highest perfection of the crop.

REQUIREMENTS OF THE TOBACCO MANUFACTURER.

In the manufacture of high-grade cigars certain essentials are necessary. The tobacco must burn smoothly and freely, with a pleasant taste—not rank and strong, nor too mild. When the taste is pleasant—not sharp and bitter—the aroma will invariably be good. The cigar that possesses the above qualities will meet with a ready sale. The wrapper of the cigar, as distinguished from the filler, must be light in color, rich in grain, thin in texture, small in vein and stem, very elastic, and of good burning quality. It should stretch and cover well, have little aroma, and appear well on the cigar. The most desirable sizes are 40 and 45 centimeter leaves, for from such leaves the manufacturer can obtain four cigar wrappers from each leaf with but little waste. After such a suitable wrapper leaf is grown, it must be properly cured, assorted, and classified. The manufacturer can never afford to pay a high price for a bale of tobacco unless he can calculate just how many suitable leaves it will contain. This is one reason why Sumatra tobacco commands such a high value, for so carefully is the grading and assorting done that the manufacturer knows how many cigars each package of tobacco will wrap, and that the color will be uniform. Wrapper tobacco should be uniform in size, color, and texture; then the buyer knows what he is getting, and is willing to pay a good price.

For cigar fillers the leaves should be somewhat shorter, of medium body, have a rich brown color, and burn smoothly and freely. The quality of the filler determines the character of the cigar; hence, the filler must possess the desirable aroma that distinguishes a good cigar.

Philippine tobacco has some of the above properties and has earned its reputation on account of its agreeable aroma, fine veins, and notable elasticity. This applies only to the better quality of tobacco grown on the alluvial lands of the Cagayan River, in northern Luzon. The tobacco grown in the Visayan Islands is coarser, uneven in color, and of greater strength. From the provinces along the west coast of northern Luzon the tobacco is of heavy body, and that grown near the sea has but little combustibility. Its ragged, broken character also lowers its market value. The tobacco grown in Nueva Ecija was formerly considered fine, but the color was a decided yellow, and the taste somewhat bitter.

PREPARATION OF SEED BED.

No step in the cultivation of tobacco is more important than proper care in the preparation and sowing of the seed beds. This work can not be neglected without running the risk of a partial or total failure of the crop. To make good seed beds is a laborious task and requires good judgment in the selection of the location, soil, and in the preparation of the land. To have plenty of good, strong, healthy plants is the surest foundation for a good crop of tobacco, provided they are from seed true to the desired standard. It is very important that in the preparation of the seed bed an abundant supply of seed should be sown, and provisions made for a succession of plants, so that when the planting season comes the supply of plants suitable for transplanting will be ample for the purpose, and the supply will be maintained throughout the period in which the planting is to be done.

The best soil for the seed bed is a rich, friable, dark, virgin loam or sandy loam. A deep, well-drained soil is greatly to be preferred. The necessary operations of tilling and stirring the soil should precede sowing the seed by several weeks. It is usually customary to thoroughly plow or spade the land and mark the land off into a number of beds surrounded by boards. In the famous Deli district in Sumatra the beds are built up about 30 centimeters high and surrounded by ditches. The size and number of the beds vary, but they are usually rectangular in shape, with suitable walks or passageways between them. The beds are highly fertilized with rich manures or with any complete, specially prepared commercial fertilizer. Stable manure, or any complete guano, may be used. Care should be taken to thoroughly mix the fertilizers with the soil, so that the greatest amount of plant food may be available for the young plants. In the case of old lands it is always advisable to burn the land over to insure safety against grass and weeds. With new land the trouble from such sources is slight; but burning is sometimes practiced to increase the richness of the soil by adding the fertilizing properties of the burned wood. The burning is usually done one week before planting the seed. After burning, the soil is well spaded and all roots and tufts are carefully removed, and the surface made loose and smooth. Then the soil is well watered and the seed mixed with sand, or sifted wood ashes are nicely spread over the surface. After the seeds are sown, the soil should be thoroughly compacted with a heavy roller and, if the soil is at all dry, the beds should be watered and kept continuously moist, but not wet, until the plants are set out. It is best to plant new seed beds at intervals of every few days, in order to be sure to always have fresh plants of proper size on hand when the time comes for transplanting. On a commercial scale it requires about 45 grams of seed to sow a bed 1 hectare in size. In the Cagayan Valley the seed is sown in the beds during the latter part of September and the first weeks of October, while the transplanting is made during the early part of December. This period of planting the seed bed varies slightly in the different parts of the archipelago on account of the varied climatic conditions; but practically all of the transplanting is done during the month of December, as experience has shown this to be the best month for such operations. In many parts of the Philippines it will be found advisable to construct some sort of cover for the seed bed to protect the seeds and tender plants from the intense heat of the sun. A suitable shelter made of straw, cogon grass, or nipa palm, raised about 1 meter above the ground, will suffice. It should be so arranged that the covering can be put close together or spread out to regulate the amount of heat received by the small plants. After a few weeks this covering can be removed altogether and kept to serve for another bed. White ants and sometimes caterpillars and worms are destructive in the seed beds, and should be removed by hand or by mixtures of poisonous substances and water known to be effective in removing such pests. When the plants are drawn for transplanting, great care should be taken to secure as much root as possible. It is usually considered the best practice to carefully wash away all particles of the seed-bed soil that cling to the roots, for the plants live and grow better when the roots are perfectly clean.

SELECTION OF THE LAND.

Few, if any, plants are so easily modified as tobacco by climate, soil, elevation, nearness to the sea, and different methods of cultivation. This is plainly demonstrated by the rapid changes which take place in the character of the leaf, flavor, aroma, and special fitness for the varied uses and for different markets in introducing seed of well-marked varieties into new districts. Each new class of soil, materially aided by climatic conditions, gives peculiar qualities to the cured leaf as to its flavor, texture, color, etc.

It has long been recognized that tobacco grown near the sea or large bodies of salt water has poor combustibility and, while the taste may be sweet, it commands a low price for the manufacture of cigars on account of its poor burning qualities.

In tropical countries the favored locations for tobacco cultivation are the interior alluvial valleys. In such places the soils are usually deep, porous, easily stirred and cultivated, and the periodic overflow of the rivers adds new fertilizing elements to the soil, already rich in plant food. The famous tobacco districts of Isabela Province belong to this class, as well as the valley lands of the provinces of the west coast of Luzon. In the Cagayan Valley the quantity of rainfall, according to two years' observation ending in 1897, is much less than at other points in the interior of Luzon, or in the southern islands. The total amount of rainfall during the year is 700 mm., the greater part of which falls during the period from June to October. During the months of January, February, and March, when the tobacco is growing and ripening, the rainfall does not exceed 20 mm. Comparing the climate of this region with the Deli district in Sumatra, it will be found that the climatic conditions of the latter region more closely resemble those of southern Luzon and some of the southern islands. The rainfall is distributed over the entire year, while the greatest amounts are recorded in October, November, and December. The total amount received during the year averages more than 2,000 mm. The stations in the Philippines, where equivalent or greater amounts of rainfall are recorded, are Bolinao in Zambales Province, Albay in southern Luzon, La Carlota in western Negros, northeastern Mindanao, and Vigan in Ilocos Sur Province.

In Sumatra, where the best results with tobacco have been obtained, the soils are mainly volcanic in origin. Where the finest and silkiest tobacco of a rich brown color is grown the soils are clayey, while the lighter colors of fine cigar-wrapper tobacco are grown on loamy and sandy soils, with clay subsoils. In the clayey soils of the Deli and Langkat districts, tobacco can often stand droughts of three weeks and longer without much injury, but in these districts the frequent light showers are of great value to the growing crop. Experience has also shown in Sumatra that the best results have been obtained on land situated from 8 to 16 kilometers from the ocean, while tobacco plantations high up on the mountains have had poor success in growing fine, silky wrapper tobacco. The lowlands, free from frequent inundations and not too near the sea, with soils consisting largely of fine sand and silt, and rich in organic matter, have given the best results.

In the Philippines many fine bodies of interior valley land, with rich, loamy soils, can be found where tobacco cultivation has not been practiced, and it is on such tracts of land that its introduction is especially recommended. Mindanao possesses many large valleys with alluvial soils that could undoubtedly be made to produce a fine quality of tobacco. The soils of the large valley between Manila and the Lingayan Gulf should be carefully tested with seed from the famous tobacco districts of the world, to determine its fitness for growing tobacco. New areas are constantly being tried in various parts of the world, where tobacco growing was unknown, and the success of so many of these should prove an incentive to greater efforts on the part of the Philippine planter to enter into competition to furnish a goodly portion of the world's supply of this profitable crop. Only very recently the cultivation of Havana tobacco has been introduced into Anam and Tokin, in French Indo-China, and a portion of the crop exported to Manila. Such an example shows what may be accomplished by careful experimentation in the field of new crops, and should stimulate the energies of farmers in every part of the archipelago.

CULTIVATION OF THE CROP.

Since the profits of growing tobacco depend largely on the planter's ability to produce a leaf of such qualities as to make it desirable to the manufacturer, it follows that the greatest care should be exercised in the cultivation of the plant. Prior to the work of transplanting, the ground should be thoroughly plowed or spaded to a considerable depth. Deep cultivation is advisable on any character of soils, as it readily allows the free percolation of rain and air through the soil, and increases the amount of available plant food contained in the soil and helps to conserve the moisture, especially in times of drought. If only small amounts of manures are to be applied, it can be spread broadcast after the first plowing; but if large quantities of stable or straw manures are used it is best to plow them in several weeks before the time of setting out the plants. After plowing, the land should be harrowed with a disk harrow and then with a smoothing harrow. In Sumatra, where all of the operations are performed by Chinese coolies, the work of breaking the soil is performed by an implement called the "tyankol," a sort of spade, which takes the place of the plow, while the work of smoothing and reducing the soil to a fine state of tilth is accomplished by hoes and iron rakes. Either by plows and harrows or by spades and rakes, the field should be made loose and smooth before transplanting or the young plants are at a disadvantage from the very start. The writer has seen many fields, especially in Batangas Province, where young tobacco plants were attempting to grow in a field filled with the hard clods of intractable clay soil. Such methods are to be condemned, for plants as tender and delicate as tobacco can not make a good growth in improperly prepared fields.

Often it will be found advisable to water the field before the work of transplanting begins. Transplanting can be done by hand or by a transplanting machine. Such a machine can only be used on level fields free from stumps, stones, or large quantities of undecomposed vegetable matter. By its use more satisfactory results are obtained, and large areas can be planted at much less expense than by hand planting. A transplanter is a two-wheeled machine, drawn by two horses or mules. One man drives while two boys drop the plants. Plants are set with mathematical regularity at any distance desired. The machine is so arranged that a supply of water is furnished at the time of planting, so that the plants are thoroughly watered while being placed in the soil. Machines of this character are widely used in the United States for setting out tobacco, cabbage, and tomato plants, with exceptionally good results. Machine-set plants start quicker and grow and mature more evenly than hand-set plants.

In Sumatra, where all necessary operations are carried on by hand, the coolie is provided with a plant string the same length as the field. Each end of the string is securely attached to a stick of the same length that it is intended the rows shall be separated. This string is divided into intervals by means of colored string to show the proper distance of the plants in the row. By means of a sharp stick holes are made at the proper distance about 10 centimeters deep and 7 centimeters in width. The holes are watered immediately before the plants are put in. The plants are pulled from the bed when the dew is still on them and set out late in the afternoon when the rays of the sun are not very strong. During the daytime the pulled plants are kept in a basket and carefully watered and covered with cloth. About 4 o'clock in the afternoon the coolie drops from the basket a plant beside each hole and when all of the plants are dropped commences to plant. He holds the plant in the center of the hole with his left hand and with his right hand presses the soil around the roots carefully but firmly, so that he can give the plant a slight pull without removing it.

As regards the number of plants to the hectare, this depends so largely on experience and the character of the soil and the kind of tobacco that special directions can not be given. Close planting in the row tends to develop a very thin leaf, while open planting allows the leaves to grow to a greater size and develops the gums and oils so common to tobacco. For cigar wrappers it is usual to plant closely in the row in order that the leaves will shade each other and develop the fine, thin leaves desired for this purpose. In Sumatra as many as 10,000 plants are set out in a field of 1¼ acres (slightly more than one-half of a hectare). For cigar fillers or for tobacco to be used for manufacturing purposes, the planting is much more widely separated than in Sumatra.

As it is always desirable to get a uniform growth, great care should be exercised to have each plant live. Replanting should be done as quickly as it is possible to determine where fresh plants are needed. If the soil is moist and showers are frequent, watering the plants is unnecessary; but if the ground is dry they should be watered immediately after setting and each day thereafter as long as the plants require it. The quantity of water used is in all cases governed by the condition and nature of the soil. Usually, after setting, the plants are undisturbed for a period of several days, during which time they are taking root. After this time cultivation should be begun and continued rapidly and frequently until further cultivation is liable to injure the growing leaves. Cultivation at first can be done by a light plow or hoe; but after the plants have reached a considerable height only the hoe should be used, and this very lightly. At this period the leaves furnish sufficient shade to prevent the soil from baking and hindering the growth of the surface roots.

Every effort is made, both through fertilizing and cultivation, to maintain a steady and rapid growth, as any check in the rate of growth tends to thicken the leaf and reduce its elasticity. Stable manures are commonly used, while fertilizers known to be rich in potash are especially to be recommended. In many parts of the United States it is customary to apply specially prepared fertilizers after the plants have attained considerable size to still further stimulate the growth of the crop. In Sumatra the crop is given three cultivations. The second cultivation is made at the time the plants are about 30 centimeters high. Just before the second cultivation the coolie carefully removes the lower leaves, places them around the stem, and packs the loose soil on these. At this second cultivation the suckers are broken off and buried in the same way as the leaves, so as to protect the stem. The work of topping and suckering varies considerably with reference to individual plants and the character of tobacco desired.

Early or low topping is not desirable, as it throws too much growth into the leaves, making them coarse and large. If the plants are thrifty and the weather favorable for growth, it is frequently advisable, if thin, fine-textured leaves are desired, not to top the plants at all, but let them produce their flowers and seed pods. If, however, the plants seem weak and it appears that they can not mature the full number of leaves, they should be topped by pinching out the "buttons," allowing to remain as many leaves as the plant will be able to mature. When plants have been topped too low and the leaves thicken and curl, a few suckers may be permitted to grow, which will remedy any thickening and curling. By using good judgment in the matter of topping and suckering, and making proper allowance as to the soil and climatic conditions, the leaves can be grown to almost any thickness that is desired.

From the time the plants begin to grow in the seed bed until they are harvested they should be examined carefully for worms, insect pests of all kinds, and all of the diseases which they are subject to. Worms may be removed by hand or by applications of mixtures containing poisonous substances, such as Paris green. For diseased plants frequently there is no other remedy than to remove the plant and reset other plants. But if the resetting is done too late the small plants never amount to much.

At the time of topping, or when the buds have made their appearance, a few plants are usually left for seed. Only the best, finest, and healthiest looking plants are selected for this purpose. These are allowed to grow and blossom at their full height. Sometimes all of the leaves are removed, but usually only the bottom leaves are taken off. When ripe, the little balls containing the seeds are carefully cut off with a knife or other sharp instrument. The cutting must be done carefully so that the seed will not fall out. The seed pods are then spread out in the sun, and when thoroughly dried the seeds can be removed. The seed should be cleaned, preferably in a small seed mill, and only the heaviest seed preserved for the next planting.

HARVESTING AND CURING.

More satisfactory results are obtained when the leaves are "primed" than when the entire stalk is cut. By cutting the entire stalk much green tobacco is carried to the shed, since all the leaves never ripen on the plant at the same time. By the system of priming the leaves are taken off the stalk as soon as they ripen and carried to the drying sheds in baskets. Sometimes half of the leaves are removed and the balance of the stalk cut and the leaves cured on the stalk. Tobacco should never be cut or primed when wet with rain or dew, as this causes the leaves to sunburn and little holes to form, which lowers the value of the leaf. If the tobacco gives promise of being "wrapper"—that is, if it is light green, very sound in leaf, and of desirable size—it should be primed at an early stage of ripening. If, however, appearances indicate that it will prove "filler" tobacco, it should be allowed to thoroughly ripen.

In the Cagayan Valley it is customary to make five gatherings of the ripened leaves at intervals of eight days. The native cuts the leaves while they are hot and drooping, collects them on his left arm until the bundle is too large, when it is placed on carts and hauled to the sheds.

The different primings should be kept separate in the shed, so that they can be fermented separately, as each set of leaves from different parts of the plant requires different treatment in the subsequent fermentation.

If the soil is rich and the season favorable, a second profitable crop can be produced from the suckers. The first suckers, of course, should be broken off from time to time; otherwise they will sap, hinder, and check the growth of the leaves. When all of the leaves have been primed from the original stalk, except four or six leaves at the top, two suckers should be allowed to grow from the bottom of the stalk. These will be well started by the time the top leaves of the original stalk are ripe. The stalk should then be cut just above where the suckers sprout, and cultivation should begin at once, by carefully placing soil up around the old stubble. The suckers should not be allowed to have more than six or seven leaves each. The growth of these will be rapid, and they will mature early. Usually these are not primed, but the stalks should be cut. In northern Luzon these mature in about three weeks and, in years of great humidity, a second crop of suckers is allowed to grow.

After harvesting, the tobacco is carried to the sheds for drying and curing. These sheds are usually large enough to hold the crop from a number of small fields. Many different kinds of drying sheds are used and differences of opinion prevail as to the relative merits of each style of shed. Some are broad and flat, others narrow and tall. The broad, flat type of barn is to be preferred, for the tobacco cures more slowly, and better results are obtained. The interior of the shed is so constructed that frequent tiers of rafters and posts allow ample support for hanging the tobacco. The doors and windows should be arranged with the idea of giving very thorough ventilation when open. The manipulation of the barn or curing shed is entirely governed by the condition of the weather and the nature of the tobacco and no fixed rules can be given. Considerable care and judgment must be exercised in the curing of the crop, and as the conditions vary in each case from year to year, only experience can determine just what is to be done to meet the new problem in the curing shed. The process requires a few weeks, especially if the leaves have been primed. The crop is considered thoroughly cured when the midribs of the leaves are cured; it is then ready to be taken to the packing house for sorting, fermenting, and baling.

Very much of the value of tobacco depends upon the infinite care that is taken throughout the whole period of its production and thorough consideration of all the details should be shown in the fermentation, grading, and sorting. The fermentation has two purposes. The first is to insure the proper texture, glossy appearance, and color to the leaf. It brings out the characteristic properties of the leaf, which are hardly apparent when the leaf is cut in the field. It is, furthermore, necessary to press the tobacco into bales, so that it can be shipped in compact form. The best results are obtained when bulk fermentation is practiced. In this method the leaves are assorted into piles, depending on what part of the stalk they have been taken from. Layer after layer of leaves are placed together, until piles of more than 1 meter are reached. The temperature in the pile gradually rises, and frequently thermometers are inserted to determine the exact degree of heat, which is never allowed to become excessive, or the tobacco will be injured. The piles are frequently turned over, to secure the proper heat and regulate the fermentation. No statement can be made as to how often the piles should be turned over, or when this should be done, as it depends upon the condition of the tobacco, especially as to how moist it was when placed in the pile. The leaves from the upper part of the stalk must be fermented more slowly than the lower leaves; consequently, the piles must be torn down and rebuilt more often. The principal fermentation is one before the sorting as, after the sorting, there are so many grades which have to be kept separate. Often these different grades are refermented to improve the quality of the leaf.

In the Cagayan Valley the tobacco is placed into packs of four bundles of from 20 to 40 leaves. These bundles are then placed into bales of 80 packs. From 1 hectare an average yield for a number of years is 612 kilos of dry leaves. The tobacco is frequently assorted with the following results: From 1 hectare, 10 packs of superior tobacco, 30 packs of first-class, 40 packs of second-class, 80 packs of third-class, 160 packs of fourth-class, and a number of packs of fifth-class tobacco. The sorting is generally carried on with reference to the colors, absence or presence of spots, length and soundness of leaf. Many divisions and subdivisions are made, according to market demands and the intended use of the tobacco. After the work of sorting and grading has been completed it is baled into compact bales, when it is ready for shipment.

GROWING TOBACCO UNDER SHADE.

The growing of crops under shade is not a new idea, but was practiced perhaps hundreds of years ago; but the cultivation of fields of tobacco under a light cloth shelter of some character is comparatively recent. The idea of using shade started in the United States in Florida, where in the last few years tobacco cultivation has made enormous advances. It was noticed that in new land, only partially cleared of the forest growth, the plants grown under the scattered trees were far superior to plants not so shaded. From this the idea of artificial shade had its birth and now large fields, nearly 5 hectares in size, are grown under shade with great success.

In addition to the experiments in Florida many trials have been made in the State of Connecticut with equal success. The character and quality of the tobacco was considerably modified and profits greatly increased. It was determined that tobacco fully equal to the finest Sumatra leaf could be grown in the Connecticut Valley on a commercial scale, and the experiments received widespread attention, and large companies have been formed to grow tobacco exclusively under shade.

By using the shade the damage from insect pests is reduced to a minimum, the moisture content of the soils is increased, while the evaporation from the leaves is largely retained, favoring a more rapid and luxurious growth. The shelter tempers to some extent the intense heat of the sun and at the same time readily allows the free passage of even the slightest showers through it.

In figure 2 is shown the general appearance of a tobacco field covered with a cheese cloth shelter. The field contains about 4½ hectares and is one of a number of large fields of shaded tobacco grown in Florida in 1899. In figure 3 is shown the details of the outside structure of the framework before the covering was put on. In figure 4 is shown the details of the framework of a shade that was used in the Connecticut Valley in 1901.[a] A strong framework is constructed of posts and stringers, that is further strengthened by strong wires secured at each end of the field by strong stakes driven well into the ground. This is covered with some light cloth, such as cheese cloth. By special request an extra wide (about 5 meters) quality of cloth was made for the season of 1902. The cloth completely covers the framework and reaches to the ground, where it is secured. Gates are provided, covered with cloth, and in the fields of large dimensions it is advisable to leave a road lengthwise through the field. Usually the cloth must be renewed each season, but the framework is built sufficiently strong to last four or five years. The height of the framework is about 3 meters, and the average total cost of the shade in the United States is about $350, United States currency, for 1 acre, 0.4 hectare. In the Philippines such a shelter could be constructed much more cheaply, on account of the cheapness of the framework, for bamboo and bejuco could be substituted largely for hard wood posts and wire.

The covering completely incloses the field, and should be made so close that few, if any, insects can enter. The protection from strong winds is very beneficial, as the leaves are often torn and lashed when the crop is not protected. Much protection is also afforded from heavy, dashing rains, which would otherwise damage the leaves. The force of the heavy rainfall is broken and frequently the crop is saved when, without protection, it would be badly torn and damaged. So much better results have been accomplished in the United States with the shade-grown tobacco that an earnest plea is made for its introduction into the tobacco districts in the Philippines. Rumors have stated that the attempt is to be made in the Cagayan Valley, but the author can not state how far these experiments have been conducted, or what success has been attained. It will, of course, be advisable to experiment on a small scale, rather than expend any considerable amount of money on materials for shading large fields. A shade of sufficient size should be constructed to determine to what extent the crop will be benefited, and then plans can be made for the erection of larger coverings.

CONCLUSIONS.

From the above, it is at once apparent that the successful cultivation of tobacco requires the greatest care and attention, from the preparation of the seed bed to the final fermentation and baling of the ripened leaves. While anyone unfamiliar with tobacco culture can probably produce a crop, it is to be doubted if it will be of such a character as to command a good price. Judgment, only to be gained through experience in growing the crop, is necessary at so many stages of the growth of the plant that it is doubtful if it is profitable for the planter to undertake its cultivation unless he can engage the services of some one who has had such experience. And yet it is possible for the careful planter, who persistently studies the requirements of the crop, in a very few years to produce tobacco of a quality superior to that grown in regions where its cultivation has been practiced for scores of years. When the Department of Agriculture attempted growing Sumatra tobacco under shade in the Connecticut Valley, the idea was greatly ridiculed by conservative New England planters, who scoffed at the idea of trying to grow a new kind of tobacco. They maintained they had grown tobacco for years, and knew the limitations of the soils and climate and the kind of tobacco best suited to the conditions. It took only one year to convince them that a new type of tobacco could be grown and sold for prices many times in advance of the best prices ever obtained for the finest of the old standard crop. And this has been the experience of tobacco cultivation the world over. Experiments have been tried in tobacco growing in new areas and in a few years, in many cases, have entirely revolutionized the agriculture in certain districts. New areas are constantly being opened up, with results that are very gratifying, even to the most sanguine experimenters.

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[a] Sketches on file in the War Department.

In the districts where tobacco cultivation has been carried on for years, no one should be contented with the results obtained, but should by constant experimentation with new seed and improved cultivation endeavor to improve the quality of the crop. Here in the Philippines it is commonly stated that the tobacco grown to-day is inferior to that formerly grown. This is greatly to be regretted, and it should be the especial effort of every planter to produce tobacco not equal to that grown a few years ago, but far superior to the finest crops that were ever harvested. The tobacco markets of the world willingly pay, and pay well, too, for tobacco of a superior quality, whether it is to be used for cigars, cigarettes, or manufacturing purposes. The trade does not pay well for common tobacco, for anyone can grow coarse, common tobacco of low grade. The quality of the tobacco must be superior to that formerly grown to command a good price, for tobacco consumers are becoming more fastidious and constantly demand better goods for their money.

The author is of the opinion that the Philippine Islands can and should produce cigar-filler tobacco that is fully equal to the finest product of the famous Vuelta Abajo district of Cuba, and a cigar wrapper equal to Sumatra tobacco. With careful attention to soil and climatic conditions, it is believed districts can be found that will raise tobacco similar in flavor and aroma to that grown in the best districts of Turkey. These results can only be obtained, however, by persistent, intelligent, well-directed efforts on the part of the planter.

Philippine tobacco to-day does not occupy the position it should, and every planter or company engaged in its cultivation should strive to place it on the high standard it deserves.

BUREAU OF AGRICULTURE.

(Farmers' Bulletin No. 7.)

REPORT ON THE INTRODUCTION AND DISTRIBUTION OF SEEDS AND PLANTS BY THE BUREAU OF AGRICULTURE.[a]

By WILLIAM S. LYON.

LETTER OF TRANSMITTAL.

MANILA, *May 1, 1903.*

SIR: I have the honor to submit herewith, a report upon some of the operations of the Division of Plant Industry since the organization of the Bureau and recommend that the same be published as Farmers' Bulletin No. 7.

Respectfully,

WM. S. LYON,
In Charge of Division of Seed and Plant Introduction.

Hon. F. LAMSON-SCRIBNER,
Chief of Bureau.

INTRODUCTION.

In the preliminary efforts of this division to introduce improved varieties of economic plants into the Philippines, serious obstacles have been encountered owing to the difficulty of obtaining reliable data as to what has been accomplished by the Spaniards. Many excellent papers are extant showing that through private channels and official sources the economic flora of the islands has been enriched by exotic species from the tropical regions of two hemispheres, but there seems never to have been any concert of action between the authorities nor any effort to record these introductions or tabulate the results. As a consequence we have had to grope and feel our way and have doubtless duplicated much elementary investigation that could have been avoided had the bureau of agriculture fallen heir to any systematic records of its predecessor's labors. Still another obstacle to success has been found in the widely varying physical conditions prevailing in different parts of the archipelago, and the difficulty in securing in any one region, where these conditions are approximately alike, a sufficient number of experienced collaborators from whose reports we feel justified at this time in drawing conclusions.

Distribution of field, forage, and vegetable seeds has been made to all of the provinces in the archipelago, and a very manifest interest in the acquisition of improved varieties developed over a large extent of territory.

The economic products of temperate regions previously introduced into these islands were chiefly from seeds grown in subtropical countries, and until importations were made by this bureau little or nothing was known of the behavior of plants developed from seeds grown in northern latitudes.

The experiments so far conducted have already demonstrated that many garden vegetables of northern origin may be grown to great perfection in these islands, but the *sine qua non* of success lies in accelerating their earliest possible development by the unstinted use of water, manure, and constant tillage. With these resources necessary to promote early maturity at hand, there is no serious obstacle to the successful commercial cultivation of very many garden crops of colder climates.

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[a] The following illustrations have been omitted from this report and are on file in the War Department:

Plate I. General view of trial grounds of Bureau of Agriculture in Malate.

Plate II. Trial plots at experiment station of Bureau of Agriculture in Malate—Eggplants and lettuce in the foreground.

Plate III. Vegetables—Lettuce, eggplants, tomatoes, okra, pease, beans—Grown on the experiment station of the Bureau of Agriculture at Batangas.

Some attention has been devoted to exploiting the excellence of our native fruits and vegetables. The facility with which they may be grown, relative assurance of a crop, and their marked acceptability to the occidental palate are sufficient to encourage their general use.

In the following pages are given brief reports on those species or varieties of plants whose introduction has been followed by more or less systematic and direct observation, supplemented by the results obtained through our collaborators in various parts of the archipelago.

To this is added a complete list of seeds and plants brought into the Philippines by the chief of the bureau.

CEREALS.

American field corns.—Six varieties have been widely distributed throughout the provinces, and the results in both growth and development have been generally disappointing. The tendency to early maturity (an inestimable feature in coutries of short seasons, but with nothing to commend it to the tropical planter) is very marked, and results in a few ears forming close to the ground. By acclimatization and careful seed selection, made over two years, and determining the proper season for planting it is hoped that this objectionable feature may be overcome or greatly modified.

Native corn is of the small Mexican type, although in parts of Negros and Luzon a variety occurs that in habit and appearance closely approaches the old standard King Phillip variety. It is far less prolific than its American prototype, but this is doubtless to be explained by the absence of those conventional operations of modern farming in America that are deemed essential to the production of a good corn crop.

Millet (*Panicum miliaceum*).—One of the more dwarf Japanese varieties was tried, as a dry-season crop, and exhibited the same early fruiting tendency as field corn. It was also found less resistant to drought.

FORAGE PLANTS.

Alfalfa (*Medicago sativa*).—Records derived from outside sources are of conflicting character, attributable doubtless to general inexperience among native planters with proper culture methods, a condition that widely distributed instructions failed to entirely overcome. The direct investigations made by the bureau, however, are full of promise for the future of this invaluable clover. Our trials conducted on sandy soils and heavy clays indicate that there are no radical climatic conditions antagonistic to success.

Here, as elsewhere, good results are assured only by a deep, thorough preliminary soil breaking, followed by such subsequent surface tillage as will insure the reduction of the soil to a good seed bed. In addition, and particularly upon the west coast, provision must also be made for irrigation and drainage.

There, season of planting has an equally important bearing; for notwithstanding a voracious appetite for water, alfalfa is easily "drowned out," and forty-eight hours of submersion is generally sufficient to destroy young seedlings.

To effect a successful result, plantings should be made toward the latter end of the rainy monsoon, when long-continued storms have abated and there are only enough occasional showers to keep the young plants in good growth. This period has the further advantage of coming toward the cooler season of the year (October and November), when conditions are more favorable to seed germination than in the hotter months.

It is of record that excessive, even inundating, rains have fallen in December, but such instances are abnormal.[a] If they occur, however, unless the plants are well advanced they may necessitate reseeding. On the western coasts alfalfa may be grown for both cutting and pasture, as the weather in the five months (January to May, inclusive) is well adapted for curing the hay. On the eastern coasts the more equable distribution of rains, the absence of a long, well-defined dry season, and the greater relative humidity would impair the process of hay curing and make the value of alfalfa problematical except as a pasture crop.

Teosinte (*Euchlaena luxurians*).—Teosinte, so far grown only as a dry-season crop and without irrigation, in two months from planting has run rapidly to seed and maturity. Portions cut prior to this time furnished a sweet, nutritious, and easily-cured fodder, and subsequent irrigation has developed a strong aftermath now ready for a second cutting. While there has been no opportunity to observe its behavior during the wet season, it is probable that upon well-drained lands it will prove a most productive forage crop of great economic value.

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[a] The average December rainfall at Manila is only 58.1 millimeters.

Sulla (*Hedysarum coronarium*).—Our preliminary tests indicate that sulla has less drought-resistance force than alfalfa. So far its trial has been restricted to light sandy soils not susceptible of irrigation and subject to a drought whose prolongation has been exceeded only once during the thirty-seven years of official meteorological records of the archipelago.

SOIL-RENOVATION PLANTS.

A number of field or forage pulses are briefly reviewed under this heading, as most of the trials were made upon lands long cropped to general uses and without return of fertilizers of any kind, and the preliminary purpose of the plantings was to determine their relative adaptability to the country and their soil-renovating values.

No soil inoculations were made.

The kinds tried have been *Glycine hispida* (soy bean), *Dolichos chinensis* (cowpea), *Dolichos multiflorus* (velvet bean), and *Lupinus varius* (blue lupine).

All were grown as dry-season crops, drill sown, well cultivated, but given no irrigation.

From none except the velvet beans were satisfactory results obtained, no crops of sufficient yield being produced to pay for soiling or for the labor of turning down as green manure. To this the velvet bean was a notable exception, amply sustaining its reputation as a dry-region product, yielding abundant and vigorous vine and seed. Samples fed to carabaos by the writer were eagerly consumed, and a ration of this well-known nutritious fodder to supplement the precarious subsistence of chance weeds and innutritious grasses that chiefly go to make up the diet of this most useful animal would doubtless result beneficially to beast and owner alike. That it will grow here and yield abundantly, if not as a spontaneous crop, at least with a minimum outlay of labor, is a feature that should commend it strongly to many native farmers.

GARDEN VEGETABLES.

A fairly wide range of experiments have been carried on with horticultural products directly under the bureau's observation and through a large circle of collaborators.

The facts as coming to this bureau, which of course must be impartially recorded, show a larger percentage of failure or poor success than one would desire to report of any planting enterprise. Yet it must not be forgotten that there were three contributing causes that would make a preponderance of ill-success during our initial year almost unavoidable. One, due to the difficulties of maintaining our seed supply in the best possible germinative condition while in our own hands and after it had gone into the hands of our consignees. This was a pregnant cause of failure, and one that happily, as the results of improved methods of packing, preserving, and shipping, will be largely obviated in future. A second cause of failure was the unprecedented and long-continued drought and the failure of springs, streams, and wells in localities heretofore under irrigation, while a third and serious factor was found in the necessity of selecting or utilizing the service of willing but perfectly untrained observers. Not only were they inexperienced in cultivation of many of the products sent to them, but their unfamiliarity with methods of recording material and useful data has impaired the value of the whole. In detail, the bureau, outside of its own definite trials, has received reports on—

Bush or snap beans.—Reports from 41 collaborators show gratifying results from 16 sources and more or less pronounced failure from 25. From central Luzon came the best records, and the poorest are accredited to the Visayan group. Our own observations show no deterioration in yield or quality, and that good crops may be assured by the maintenance of proper conditions.

Lima and pole beans.—These proved equally satisfactory, and where protected from inundation by listing or hilling-up the land will doubtless flourish as well as the indigenous *Phaseolus lunatus* that is so largely grown as a perennial throughout the archipelago under the name "patani." Our cultivated limas are in all respects as to quality and productiveness very much superior to, and will, in time, I think, supersede the "patani."

Garden pease.—Outside reports have in general been even less satisfactory than those made with beans, and our own trials, while satisfactory, have been merely confirmatory of the hypothesis that their development would only be good when planted during the coolest season of the year (December to March) and irrigated.

Exotic cucurbitaceæ.—Of these a great variety of squashes, vegetable marrows, pumpkins, cucumbers, and muskmelons and watermelons have been tried, and the long record of disaster is practically all confined to the ravages of insects or fungus diseases. Our own plantings quickly succumbed to a blight that the early and frequent application of boulli bordelaise was powerless to subdue, but we experienced no difficulty in holding insect foes in check by the application of conventional sprays. The omnipresent *Diabrotica* appears in clouds, and without unremitting warfare the planter of exotic cucurbits engages in a hopeless undertaking.

The blights appear to be the same as those that have at times devastated the melon and cucumber fields of the middle western United States, and may in all likelihood be held in suspense by the application of timely prophylactic sprayings.

Still more valuable I esteem the information derived from many native Filipino gardeners as to the influence that time of planting bears upon the control of these diseases, the hypothesis, and a very plausible one, being that the spores of the disease are inactive or dormant during the dry season, and consequently plants reared at that time will escape all attacks.

While it is imprudent to generalize from isolated cases, I will cite the fact that I observed, in Cavite Province, upon lands analogous to those of our own station and located like the latter at sea level, both melons and cucumbers of surpassing excellence, grown from American seeds distributed by the bureau, but not planted until late into the dry season. These had received irrigation, but no treatment for disease of any kind, and their general condition was such as to excite the admiration of the most critical horticulturist. The native cucurbits, which contribute by far the most important green element to the Filipino menage, are by no means immune from this disease, and their almost universal practice of late or middry-season planting furnishes an invaluable and probably unerring guide to the successful cultivation of this class of plants at sea level. Our own previous recommendations, based upon insufficient knowledge of local conditions, advising planting of cucurbitaceæ toward the close of the rainy season, will be accordingly modified to meet the obvious benefits that will probably follow the use of the Filipino method.

All exotic cucurbits are extremely sensitive to decay of leaf, vine, and fruit, if subjected to the slightest overflow or inundation, and a further acceptance of the Filipino trellis system seems unavoidable where late or lenten-season planting of late-maturing varieties promises to defer the fruiting epoch until the advent of the heavy June rains.

The Solanaceæ.—As was to be anticipated, many representatives of this largely tropical order have given encouraging results. From our few tests made with potatoes it is yet too early to forecast results, although it is altogether safe to aver that south of 15° north latitude no commercial planting under an elevation of 600 meters can successfully be made. Seed of very great promise was received by the bureau through the kindness of Maj. W. W. Robinson, jr., U. S. Army, and has been sent to our station at Benguet for purposes of propagation.

Eggplants, tomatoes, and peppers, all of unrivaled size and excellence, are generally reported by our collaborators and from our own agronomic stations.

The experiences of the Spaniard and of the Filipino indicate a rapid degeneration in size and quality, even in the second generation of these products, when reared from home-grown seeds.

Whether a high standard can be maintained by careful seed selection—an operation generally unknown to the Filipino horticulturist—or, if annual importation of northern-grown seeds of plants originally of tropical origin such as the foregoing must continuously be made, is one of the problems for investigation now before this bureau.

The Liliaceæ.—A native onion, small in size and rank in quality, is common throughout the islands. In Batangas Province it is, in fact, grown upon a considerable commercial scale for distribution in the Manila markets. Our American varieties have not in general responded well to our own efforts nor those of outside planters. Our investigations have gone far enough to indicate that this product is also emphatically a cool-season crop that may be sown with hope of success only toward the end of the rainy monsoon. Leeks have been planted with more general success, and the widely disassociated genus, asparagus, is giving excellent promise of future success.

Miscellaneous genera.—Okra (*Hibiscus esculentus*), of topical Asiatic origin, as was to be expected, has given universally good results. Beets, turnips, lettuce, endive, spinach, and radishes are among that class early referred to in this paper whose successful and profitable production, we have abundantly demonstrated, is assured by an intense high forcing system inaugurated from the day the seed is sown until the crop is secured. Early varieties of cabbage proved disappointing, so far as our own immediate trials went, although a very considerable number of our collaborators report "headed out well." Cauliflower was a failure, notwithstanding tests made with seeds from the extra tropics of Algeria. Sweet or table corn, like the field varieties, developed the same tendency to dwarf and tassel out when but a few inches high, while on the other hand it must be admitted that from Panay Province we have reports of good growth, good crop, and good quality. Rhubarb and celery have both made a creditable and satisfactory start, but at the time of this writing it is premature to forecast their final outcome.

OIL-YIELDING SEEDS.

Of these, sesamum, rape, peanuts, and sunflower have all had preliminary trials during a dry season and without irrigation.

The first and last of these have given unqualified and excellent returns. Rape early in the season succumbed to heat, and was especially subject to the devastation of aphis. Of peanuts we have but scanty and contradictory reports. The seeds imported by the bureau of the most select sort grown in Virginia in size, appearance, and productiveness seem to offer no improvement on the kind in general cultivation.

In Batangas Province peanuts are primarily grown for the pony forage that the ripened vines afford. The groundnuts themselves, of excellent quality, are secured for food, but seem to be a secondary consideration. Peanut culture in most tropical countries, as we well know, is for the purpose of oil making. In the Philippines this industry is as yet unknown.

Sunflower under truly adverse circumstances has developed a fine growth and a large seed yield. Its further exploitation is to be recommended.

The success that has followed our trials with *Sesamum indicum* calls for a somewhat extended notice. So far as I recall, the small order *Pedalinæ*, to which this plant belongs, is of exclusive tropical Asiatic or Malaysian origin, and its excellent behavior here was in a measure to have been anticipated. In fact the black-seeded variety is reported by Blume [a] as indigenous to Java, and the same kind has been more or less grown as a minor product for many years in these islands. But the white-seeded and by far the most useful variety I have not encountered, and the presumption is strong that the present instance is its initial introduction into this archipelago. Through circumstances altogether unavoidable our plantings in January were made a full month or more too late in the season and with soil conditions far from being of the best. Notwithstanding this, growth and final crop returns were of the best. Our observations also go to show comparative freedom from the many insect pests, unending warfare with which makes the cultivator's life no sinecure.

From several creditable sources I am also assured of the absolute immunity of this plant from the ravages of the locust that in frequent years devastates the fields of every living green thing. Whenever positive verification of this is forthcoming it should place the culture of this plant on a plane of the highest commercial rating.

There is a practically unlimited demand for sesamum oil in both the Orient and in the West, and of that the product of the white-seeded, on account of its lighter and better color, is most in demand at the best price. It responds (in this climate) to such primitive cultural methods, and its harvests, suitable to the labor of women and children, is attended with so much facility and at so insignificant an outlay of cultivating and harvesting implements that it recommends itself strongly to the attention of the small proprietor. Its cultivation here upon a considerable scale would be soon followed by the necessary factories to reduce it to a finished product and in the incidental production of a high-standard cattle food and fertilizer help to solve one of the most vexing and vital questions of Philippine agriculture.

FRUIT-BEARING PLANTS.

Some importations of tropical and subtropical plants and a very few species of strictly temperate-region fruit trees have been made by the bureau and planted at different elevations. Some of these last named were planted near Abúcay, Bataan Province, in latitude 14° 45′ north, at an altitude of 300 meters, and others in Benguet, 16° 30′ north, at an approximate elevation of 1,300 meters.

At sea level the various forms of improved orange that the bureau has introduced have made excellent growth and give much promise. It is to be expected, however, that the fine and attractive color that contributes so much to the appearance of the cultivated oranges desired from extratropical sources may be lost with their transition to the Tropics.

Citrus fruit of a few species and many varieties is common in and indigenous to many parts of the archipelago. In particular, a variety of *Citrus decumana* which grows at sea level in various parts of Paragua Province is worthy of more than passing mention. Its uncommon size (in some instances quite 15 meters), great vigor, excellent form, and positive freedom from any traces of insect or fungus disease strongly commend it as of value for the reproduction of the best occidental types of the orange and lemon. The fruit is altogether worthless. Excellent sweet oranges are grown in Cuyo and other islands, especially in Batangas Province.

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[a] Bijdragen, p. 778.

On the bureau's trial grounds at Manila a very limited number of Japanese plums, loquats, persimmons, chestnuts, and grapes have been tried, together with Japanese types of *Citrus aurantium* var. *nobilis* and a few pomegranates. The grapes and persimmons have made a good initial start, and the progress of the citrus fruits and of the pomegranates has been of the best.

TEXTILE PLANTS.

Cotton.—Experiments with textile plants have been confined to cotton and jute. Both have heretofore been grown in the archipelago as minor products—the jute as a spontaneous and the cotton mainly as a perennial crop, but uncultivated. Our distributions of cotton seeds have mainly been of varieties grown in the southern United States, and although we have generally good results reported there is the remaining doubt if the native grower has an adequate comprehension of the standard crop requirements of cotton-growing countries.

Varieties of Egyptian and Brazilian origin are all that seem heretofore to have found any particular favor with native growers. The facility with which the lint is stripped from the former varieties, the absence of any gins, and the very primitive hand-linting substitutes probably have much to do with the neglect, not to say discredit, of American varieties.

Our own observations indicate that in general the tendency to early and continuous flowering may be overcome by planting after the mid-rainy season and by good tilth a vigorous growth may be promoted. Then, with the check that the cooler and the dryer season brings and the lay-by of cultivation promotes, the plant will develop the crop rather than the individual inflorescence so essential to its economical harvesting. We have had no reports indicating wilt or other diseases incident to the cotton plant.

Jute (*Corchorus capsularis*).—The climatic conditions are evidently unexcelled for the fullest development of this plant.

Under the most discouraging environment it nevertheless developed a sufficient growth to promise excellent returns if given reasonable cultural assistance.

The extended cultivation of jute should be strongly encouraged in these islands. The world's market for cheap baggings and gunnies is practically unlimited, and as yet there has been no textile fiber grown that so well subserves their manufacture as jute. The relative facility, as compared with abacá, with which the fiber is prepared offers a larger inducement to the general planter than does abacá. The export trade of British India in this fiber, amounting to some $15,000,000 annually, could be largely diverted to this archipelago.

MISCELLANEOUS PRODUCTS.

Coffees.—Liberian and the Maragogype hybrids have both been imported from Java and distributed to planters interested in the attempt to rehabilitate the coffee industry. The bureau has also raised successfully many thousands of young plants destined for planting out under its own direction.

The most recent investigations into coffee enemies and diseases indicate that these species enjoy no specific immunity from disease or insects, but their greater vitality and vigor make them resistant in so far that they are better able to sustain these attacks than the feebler growing Arabian types. There has, so far as the writer can ascertain from inquiry and personal investigation of the coffee-growing districts, never been the faintest attempt made to grow the coffee plant other than as a spontaneous product, and there are reasonable grounds to believe that under the influence of clean, open culture and the use of these vigorous-growing stocks the encroachment of both fungus diseases and insect pests may be successfully held in check.

Tobacco.—Through the kindness of Prof. D. G. Fairchild, of the United States Department of Agriculture, the bureau secured seeds of selected strains of the best Sumatra wrapper seed. Some of this was distributed in the famous Isabela and Cagayan tobacco districts. Plantings have also been made upon the trial grounds in Malate under the bureau's control, and until now, the approach of the harvest, its planting has been highly satisfactory. Trials have been made in the open and under cover, and the findings of the result when curing is completed will probably be made the subject of a future bulletin.

"*Seguidillas*" (*Psophocarpus tetragonolobus D. C.*).—This is a leguminous vine widely spread over the Asiatic tropics and is spontaneous in most parts of the archipelago. Its merit and excellence have so attracted the attention of outsiders that enterprising Australian seed growers now catalogue the seed under the name of "asparagus pea." The plant is very prolific of tender angular pods, which when boiled have a distinct asparagus-like flavor. It is a strong-growing and long-cropping legume, producing from

October-sown seeds abundant yields from November to March. It is very highly prized by the natives, and there are few garden vegetables of northern origin that would be better appreciated by Americans.

Bobug (*Sterculia fœtida*).—An excellent nut-yielding tree of extraordinarily rapid development. It fruits at an early age, probably the third or fourth year, and produces an abundance of wholesome and nutritious seeds not unlike in size and taste the piñon or western pine nut.

The tree grows to great size and adapts itself to any and every soil or locality.

Casuy (*Anacardium occidentale*).—A New World introduction of long standing in these islands that has become sparingly spontaneous in many localities. The general planting of casuy can not be too strongly commended as an article both of food and export. The tree begins to fruit in its earliest life (sometimes the second year), and bears largely increasing and regular crops every succeeding year. Its domestic value lies in its being the only native nut-bearing tree of a quality and excellence that compares favorably with the best nuts of Western markets. These nuts are delicious eaten raw and still further improved by roasting. Under pressure they yield about 40 per cent of a bland light oil of much greater value than pure olive oil, which rates on the same plane with the best grades of almond oil. The plant serves a number of local domestic purposes and the curiously engorged torus is in some demand as a fresh fruit. In Cuyo I observed trees 7 to 8 meters in height and crown diameter whose single crop of nuts, I think, could have been conservatively estimated at not less than 10 kilos.

Citrus limonum.—A variety from Lepanto-Bontoc, different from anything figured or described by Bonavia, and more probably of Philippine than Indian origin. The tree is only lightly spinescent and of remarkably vigorous growth, plants only three months from the seed measuring 25 to 30 centimeters. The fruit is large size, long-oblong, and of good keeping quality. The skin is thin, smooth, and very highly colored, and the flesh juicy, acid, and abundant. A rather large seed production is its single defect. In other respects it will compare to advantage with some of the best seedlings of European or Californian origin. Its cultivation on a large scale should result in supplanting the now considerable foreign importation of lemons to these islands.

List of seeds and plants introduced.

CEREALS.

Name.	Variety.	Whence derived.
Buckwheat	Japanese	United States.
Corn (field)	Burpee's Golden Beauty	Do.
	Cocke's Prolific	Do.
	Improved Southern White Snowflake	Do.
	Virginia White Dent	Do.
	White Cap Dent	Do.
	White Majestic	Do.
Millet	Pearl	Do.
Oats	Georgia Turf	Do

FORAGE.

Alfalfa		United States.
Bermuda grass		Do.
Clover	Italian Crimson	Italy.
Corn	Kafir	United States.
Paspalum dilatatum		Do.
Cane	Early Amber	Do.
	Early Orange	Do.
Hedysarum coronarium	Sulla	Italy.
Euchlaena luxurians	Teosinte	United States.

GARDEN VEGETABLES.

Artichoke	Large Green Globe	United States.
Asparagus	Barr's Mammoth	Do.
	Columbian Mammoth White	Do.
Beans (bush)	Best of All	Do.
	Curries's Rustproof Golden Wax	Do.
	Dwarf Horticultural	Do.
	Early Prolific Dwarf German	Do.
	Early Round Yellow	Do.
	Extra Early Red Valentine	Do.
	Extra Early Refugee	Do.
	Goddard or Boston Favorite	Do.

List of seeds and plants introduced—Continued.

GARDEN VEGETABLES—Continued.

Name.	Variety.	Whence derived.
Beans (bush)	Golden Wax	United States.
	Improved Early Round-Pod Red Valentine	Do.
	New Pencil Pod Black Wax	Do.
	Refugee Wax	Do.
	Rustproof Golden Wax	Do.
	Saddleback Wax	Do.
	Stringless Green Pod	Do.
Beans (lima)	Burpee's Bush	Do.
	Dreer's Bush	Do.
	Willow Leaf	Do.
	Wood's Prolific Bush	Do.
Beans (pole)	Kentucky Wonder	Do.
	King of the Garden	Do.
	Lazy Wife	Do.
	White Creaseback	Do.
Beets	Crosby's Egyptian	Do.
	Detroit Dark red	Do.
	Eclipse	Do.
	Edmand's Early Turnip	Do.
	Stinson	Do.
Borecole	Dwarf German	Do.
Brussel's sprouts	Paris Market	Do.
Cabbage	All seasons	Do.
	Burpee's Allhead Early	Do.
	Burpee's Surehead	Do.
	D'Hiver Parapluie	France.
	Early Etampes	United States.
	Early Jersey Wakefield	Do.
	Early Winnigstad	Do.
	Extra Early Express	Do.
	Fottler's Drumhead	Do.
	Henderson's Early Summer	Do.
	Large Late Drumhead	Do.
	Montgibello	Italy.
	Premium Flat Dutch	United States.
Carrot	Chantenay	Do.
	Early Scarlet Horn	Do.
	Scarlet Golden Ball	Do.
Cauliflower	Early Snowflake (Henderson's)	Do.
	Extra Early Dwarf Erfurt	Do.
	Extra Early Paris	Do.
	Primus	Italy.
Celery	Evan's Triumph	United States.
	Golden Self-Blanching	Do.
	White Plume	Do.
Collards	Georgia	Do.
Corn (sweet)	Country Gentleman	Do.
	Crosby's Early	Do.
	Earliest Sheffield	Do.
	Early Cosmopolitan	Do.
	Early Fordhook	Do.
	Early Minnesota	Do.
	Kendel's Early Giant	Do.
	Shoe Peg	Do.
	Stowell's Evergreen	Do.
Cucumber	Burpee's Giant Pera	Do.
	Corosan	Italy.
	Coy's Early Cyclone	United States.
	Fordhook White Spine	Do.
	Formosa	Italy.
	London Long Green	United States.
	New Extra Early White Spine	Do.
	Paris Pickling	Do.
	Thorburn's Everbearing	Do.
Eggplant	Early Dwarf Red Purple	Do.
	Fordhook Improved Spineless	Do.
	New York Improved Large Purple	Do.
Endive	Giant Fringed	Do.
	Green Curled	Do.
	White Curled	Do.
Garlic		Do.
Leek	London Flag	Do.
	Scotch Champion	Do.
Lettuce	Big Boston	Do.
	Boston Market	Do.
	Black-Seeded Tennis Ball	Do.
	California Butter	Do.
	Deacon	Do.
	Grand Rapids	Do.
	Hanson	Do.
	Nansen	Do.
	Philadelphia Early Dutch Butterhead	Do.

List of seeds and plants introduced—Continued.

GARDEN VEGETABLES—Continued.

Name.	Variety.	Whence derived.
Martynia	Proboscidea	United States.
Melon (musk)	Burpee's Matchless	Do.
	Early Nutmeg	Do.
	Early Jenny Lind	Do.
	Extra Early Hackensack	Do.
	Golden Eagle	Do.
	Jersey Belle	Do.
	Netted Gem	Do.
	Paul Rose	Do.
	Rocky Ford	Do.
	Sorts	Italy.
Melon (water)	Cuban Queen	United States.
	Duke Jones	Do.
	Frame's Santiago	Do.
	Ice Cream	Do.
	Kolb's Gem	Do.
	Kleckley's Sweet	Do.
	Long White Icing	Do.
	Mountain Sweet	Do.
	McIver Sugar	Do.
Okra	Dwarf Prolific	Do.
	Lady Finger	Do.
	Perkin's Mammoth	Do.
Onion	American Prize Taker	Do.
	Australian Brown	Do.
	Extra Early Barletta	Do.
	Extra Early Red	Do.
	Extra Early White Pearl	Do.
	Large Red Globe	Do.
	Large Yellow Globe	Do.
	Large Yellow Strasburg	Do.
	Large White Globe	Do.
	Philadelphia Silverskin	Do.
	Red Wethersfield	Do.
	Silver King	Do.
	White Portugal	Do.
	Yellow Danvers	Do.
Parsnip	Improved Guernsey	Do.
Pease	Alaska	Do.
	American Wonder	Do.
	Bliss's Everbearing	Do.
	Bliss's Abundant	Do.
	Burpee's Best Extra Early	Do.
	Dwarf White Marrowfat	Do.
	Extra Early Premium Gem	Do.
	First and Best	Do.
	Heroine	Do.
	Improved Stratagem	Do.
	Pride of the Market	Do.
	Prosperity	Do.
	Yorkshire Hero	Do.
Pepper	Bird s Eye	Do.
	Black Nubian	Do.
	Bull Nose	Do.
	Coral Gem	Do.
	Chinese Giant	Do.
	Red Chili	Do.
	Red Cluster	Do.
	Ruby King	Do.
Radish	Chartier	Do.
	Extra Early Scarlet Turnip	Do.
	Long Cardinal	Do.
	Scarlet Button	Do.
	White Strasburg	Do.
Rhubarb	Prince Albert	Italy.
Salsify	Sandwich Island Mammoth	United States.
Spinach	New Victoria	Do.
Squash	Boston Marrow	Do.
	Cocozelle Bush	Do.
	Cocozella of Tripoli	Italy.
	Early White Bush	United States.
	Early Yellow Bush	Do.
	Faxon	Do.
	Golden Summer	Do.
	Hubbard	Do.
	Mammoth White Bush	Do.
Tomato	A Tige Raide de Laye	France.
	Burpee's Matchless	United States.
	Fordhook First	Do.
	Helios	Italy.
	Ignotum	United States.

List of seeds and plants introduced—Continued.

GARDEN VEGETABLES—Continued.

Name.	Variety.	Whence derived.
Tomato	Livingston's Perfection	United States.
	Paragon	Do.
	Ponderoso	Do.
	Sparks's Earliana	Do.
	Stone	Do.
	Success	Do.
Turnip	Early Purple Strap Leaf	Do.
	Early Red	Do.
	Early White Flat Dutch	Do.

FRUITS.

Castanea japonica	Chestnut	Japan.
Citrus aurantium	Nobilis	Do.
Citrus decumana	Pomelo	Do.
Citrus japonica	Kumquot	Do.
Citrus trifoliata	Pomelo	Do.
Diospyros kaki	Persimmon	Do.
Eriobotrya japonica	Loquat	Do.
Prunus japonica	Plum	Do.
Punica granatum	Pomegranate	Do.

GUM OR RESIN YIELDING PLANT.

Manihot glaziovii	Ceara rubber	India.

LAND-RENOVATION SEEDS.

Cowpea	The Clay	United States.
	Whippoorwill	Do.
Lupinus varius	Lupine	France.
Soja bean		Japan.
Velvet bean		Do.

MISCELLANEOUS.

Bambusa species	Bamboo	Japan.
Cinnamomum camphora	Camphor	Do.
Dioscorea japonica	Yam	Do.
Coffee	Liberian	Java.
	Maragogype hybrid	Do.
Glycyrrhiza	Glabra	France.
Pumpkin	Big Tom	United States.
	Genuine Mammoth	Do.
	Golden Oblong	Do.
	Large Cheese	Do.
Tobacco	Connecticut	Do.
	Havana	France.
	do	United States.
	Sumatra	France.
	do	Sumatra.
	do	United States.

OIL-YIELDING SEEDS.

Peanut	Improved Virginia	United States.
Poppy	Opium	France.
Sesamum	Indicum	Do.
Sunflower	Mammoth Russia	United States.

POT HERB SEEDS.

Caraway		Italy.
Lavandula vera		Do.
Origanum vulgare		Do.

TEXTILE PLANTS.

Cochorus textilis		France.
Cotton	Egyptian	Do.
	Neapolitan	Italy.

BUREAU OF AGRICULTURE.

(Farmers' Bulletin No. 8.)

THE COCOANUT, WITH REFERENCE TO ITS PRODUCTS AND CULTIVATION IN THE PHILIPPINE ISLANDS.[a]

By WILLIAM S. LYON.

LETTER OF TRANSMITTAL.

BUREAU OF AGRICULTURE,
Manila, June 1, 1903.

SIR: In responding to numerous inquiries about the cocoanut, its uses, cultivation, and preparation for market, I have prepared, by your direction, the accompanying bulletin, which is intended to cover the general field of the inquiries addressed to this bureau, and herewith submit the same, with the recommendation that it be published as Farmers' Bulletin No. 8.

Respectfully,

WM. S. LYON,
In Charge of Division of Plant Industry.

To Hon. F. LAMSON-SCRIBNER,
Chief Bureau of Agriculture, Manila.

INTRODUCTION.

The following pages are written chiefly in the interests of the planter, but the writer feels that the great agricultural importance which the cocoanut palm is bound to assume in these islands is sufficient to justify the presentation of some of its history and botany.

For that part of the bulletin which touches upon the botany of the cocoanut I am indebted to Don Regino Garcia, associate botanist of the forestry bureau; for that relating to its products and local uses, to the courtesy of manufacturers in Laguna; and for the rest to personal experience and observations made in Laguna Province and in the southern Visayan Islands where, as elsewhere in this archipelago, the cocoanut may properly be considered a spontaneous and not a cultivated product.

HISTORY.

The legendary history of the "Prince of Palms,"[b] as it has been called, dates back to a period when the Christian era was young, and its history is developing day by day in some new and striking manifestation of its utility or beauty. It seems not unreasonable to assume that much of the earlier traditionary history of the cocoanut may have been inspired as much by its inherent beauty as by its uses. Such traditional proverbs or folklore as I have gathered in the Visayas recognize the influence of the beautiful, in so far as the blessings of the trees only inure to the good; for instance, "He who is cruel to his beast or his family will only harvest barren husks from the reproving trees that witness the pusillanimous act;" and, again, "He who grinds the poor will only grind water instead of fat oil from the meat."

To this day the origin of the cocoanut is unknown. De Candolle (Origin of Cult. Plants, p. 574) recites twelve specific claims pointing to an Asiatic origin, and a single, but from a scientific standpoint almost unanswerable, contention for an American derivation. None of the remaining nineteen species of the genus Cocos are known to exist elsewhere in the world than on the American Continent. His review of the story results in the nature of a compromise, assigning to our own islands and those to the south and west of us the distinction of having first given birth to the cocoanut, and that thence it was disseminated east and west by ocean currents.

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[a] The following illustrations accompanying this report are on file in the War Department: A young cocoanut tree; Fig. 1.—Cocoanut husk-crushing mill; Fig. 2.—Cocoanut fiber-extracting machine; a group of sprouting nuts; germination of cocoanut.

[b] "The Prince of Palms," Treloar.

BOTANY.

The cocoanut (*Cocus nucifera* Linn.) is the sole oriental representative of a tropical genus comprising nineteen species, restricted, with this single exception, to the New World.

Its geographical distribution is closely confined to the two Tropics.[a]

Not less than nineteen varieties of *C. nucifera* are described by Miquel and Rumphius, and all are accepted by Filipino authors.

Whether all of these varieties are constant enough to deserve recognition need not be considered here. Many are characterized by the fruits being distinctly globular, others by fruits of a much prolonged oval form, still others by having the lower end of the fruit terminating in a triangular point.

In the Visayas there is a variety in which the fibrous outer husk of the nut is sweet and watery, instead of dry and astringent, and is chewed by the natives like sugar cane. Another variety occurs in Luzon, known as "Pamocol," the fruit of which seldom exceeds 20 centimeters in diameter. There is also a dwarf variety of the palm, which rarely exceeds 3 meters in height, and is known to the Tagalogs as "Adiavan."

These different varieties are strongly marked, and maintain their characters when reproduced from seed.

USES.

The cocoanut furnishes two distinct commercial products—the dried meat of the nut, or copra, and the outer fibrous husk. These products are so dissimilar that they should be considered separately.

COPRA AND COCOANUT OIL.

Until very recent years the demand for the "meat" of the cocoanut or its products was limited to the uses of soap boilers and confectioners. Probably there is no other plant in the vegetable kingdom which serves so many and so varied purposes in the domestic economy of the peoples in whose countries it grows. Within the past decade chemical science has produced from the cocoanut a series of food products whose manufacture has revolutionized industry and placed the business of the manufacturer and of the producer upon a plane of prosperity never before enjoyed.

There has also been a great advance in the processes by which the new oil derivatives are manufactured. The United States took the initiative with the first recorded commercial factories in 1895. In 1897 the Germans established factories in Mannheim, but it remained for the French people to bring the industry to its present perfection.

According to the latest reports of the American consul at Marseilles, the conversion of cocoanut oil into dietetic compounds was undertaken in that city in 1900 by Messrs. Rocca, Tassy, and de Roux, who in that year turned out an average of 25 tons per month. During the year just closed (1902) their average monthly output exceeded 6,000 tons and, in addition to this, four or five other large factories were all working together to meet the world's demand for "vegetaline," "cocoaline," or other products with suggestive names, belonging to this infant industry.

These articles are sold at gross price of 18 to 20 cents per kilo to thrifty Hollandish and Danish merchants, who, at the added cost of a cent or two, repack them in tins branded "Dairy butter" and, as such, ship them to all parts of the civilized world. It was necessary to disguise the earlier products by subjecting them to trituration with milk or cream; but so perfect is the present emulsion that the plain and unadulterated fats now find as ready a market as butter. These "butters" have so far found their readiest sale in the Tropics.

The significance of these great discoveries to the cocoanut planter can not be overestimated, for to none of these purely vegetable fats do the prejudices attach that so long and seriously have handicapped those derived from animal margarin or margarin in combination with stearic acid, while the low fusion point of pure dairy butters necessarily prohibits their use in the Tropics outside of points equipped with refrigerating plants. The field, therefore, is practically without competition, and the question will no longer be that of finding a market, but of procuring the millions of tons of copra or oil that this one industry will annually absorb in the immediate future.

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[a] The cocoanut palm has been reared as far north as Indian River, Florida, latitude 28° N., but has not proven a profitable commercial venture.

Cocoanut oil was once used extensively in the manufacture of fine candles and is still occasionally in demand for this purpose in the Philippines, in combination with the vegetable tallow of a species of Stillingia. It is largely consumed in lamps made of a tumbler or drinking glass half filled with water, on top of which float a few spoonfuls of oil, into which the wick is plunged. In remote barrios it is still in general use as a street illuminant, and so perfect is its combustion that under a constant flicker it emits little or no smoke.

When freshly expressed the oil is an exceptionally good cooking fat and enters largely into the dietary of our own people. The medicinal uses of the oil are various, and in the past it has been strongly advocated for the cure of eczema, burns, as a vermifuge, and even as a substitute for cod-liver oil in phthisis. Its medicinal virtues are now generally discredited, except as a restorative agent in the loss of hair resulting from debilitating fevers. Its value in this direction may be surmised from the splendid heads of hair possessed by the Filipino women, who generally use the oil as a hair dressing.

Cocoanut oil is derived from the fleshy albumen or meat of the ripe fruit, either fresh or dried. The thoroughly dried meat is variously known as copra, coprax, and copraz. The exportation of copra is detrimental to the best interests of the planter, tending to enrich the manufacturer and impoverish the grower. The practice, however, is so firmly established that the writer can only record a probably futile protest against its continuance.

The causes which for a long time will favor the exportation of copra instead of oil in this archipelago may be briefly stated as follows:

(1) An oil-milling plant, constructed with due regard to economy of labor and the production of the best quality of oil, would involve an outlay of capital of $2,500 gold and upward, according to capacity. The production of copra requires the labor of the planter's hands only.

(2) The oil packages must be well-made barrels, casks, or metallic receptacles. The initial cost of the packages is consequently great, their return from distant ports impracticable, and their sale value in the market of delivery is not sufficient to offset the capital locked up in an unproductive form. On the other hand, copra may be sold or shipped in boxes, bags, sacks, and bales, or it may even be stored in bulk in the ship's hold.

(3) When land transportation has to be considered, the lack of good roads still further impedes the oil maker. He can not change the size and weight of his packages from day to day to meet the varying passability of the trail. On the other hand, packages of copra may be adjusted to meet all emergencies, and the planter can thus take advantage of the market conditions which may be denied to the oil maker.

(4) Perhaps the most serious difficulty the oil maker has to contend with is the continuous discouragement he encounters from the agent of foreign factories, who buys in the open market and, bidding up to nearly the full oil value of the copra, finds an ample manufacturer's profit paid by the press cake, so valuable abroad, but, unfortunately, practically without sale or value here. The residue from the mill may be utilized both for food and for manure by the oil maker who is a tree owner and who maintains cattle. For either of these purposes its value rates closely up to cottonseed cake, and the time is not remote when it will be recognized in the Philippines as far too valuable a product to be permitted to be removed from the farm excepting at a price which will permit of the purchase at a less figure of an equivalent in manure. So active are the copra-buying agents in controlling this important branch of the industry that they refuse to buy the press cake at any price, with the result that, in two instances known to the writer, they have forced the closure of oil-milling plants and driven the oil maker back to his copra.

Many copra-making plants in India and Ceylon are now supplied with decorticating, breaking, and evaporating machinery. The process employed in this archipelago consists in first stripping the ripe fruit of the outer fibrous husk. This is effected by means of a stout steel spearhead, whose shaft or shank is embedded firmly in the soil to such a depth that the spear point projects above the ground rather less than waist high. The operator then holds the nut in his hands and strikes it upon the spear point, gives it a downward, rotary twist, and thus, with apparent ease, quickly removes the husk. An average operator will husk 1,000 nuts per day, and records have been made of a clean up of as many as 3,000 per day. The work, however, is exceedingly hard and involves great dexterity and wrist strength.

Another man now takes up the nut and with a bolo strikes it a smart blow in the middle, dividing it into two almost equal parts. These parts are spread out and exposed to the sun for a few hours, or such time as may be neccssary to cause the fleshy albumen to contract and shrink away from the hard outer shell, so that the meat may be easily detached with the fingers.

Weather permitting, the meat thus secured is sun dried for a day and then subjected to the heat of a slow fire for several hours. In some countries this drying is now effected by hot-air driers, and a very white and valuable product secured; but in the Philippines the universal practice is to spread out the copra upon what may be called a bamboo grill, over a smoky fire made of the shells and husks, just sufficient heat being maintained not to set fire to the bamboo. The halves, when dried, are broken by hand into still smaller irregular fragments, and subjected to one or two days of sun bath. By this time the moisture has been so thoroughly expelled that the copra is now ready to be sacked or baled and stored away for shipment or use.

All modern cocoanut-oil mills are supplied with a decorticator armed with revolving discs that tear or cut through the husk longitudinally, freeing the nut from its outer covering and leaving the latter in the best possible condition for the subsequent extraction of its fiber. This decorticator is fed from a hopper and is made of a size and capacity to husk from 500 to 1,000 nuts per hour.

Rasping and grinding machinery of many patterns and makes, for reducing the meat to a pulp, is used in India, Ceylon, and China; and, although far more expeditious, offers no improvements, so far as concerns the condition to which the meats are reduced, over the methods followed in the Philippines. Here the fleshy halves of the meat are held by hand against a rapidly revolving, half-spherical knife blade which scrapes and shaves the flesh down to a fine degree of comminution. The resulting mass is then macerated in a little water and placed in bags and subjected to pressure and the milky juice which flows therefrom is collected in receivers placed below. This is now drawn off into boilers and cooked until the clear oil is concentrated upon the surface. The oil is then skimmed off and is ready for market.

The process outlined above is very wasteful. The processes I have seen in operation are very inadequate, and I estimate that not less then 10 per cent of the oil goes to loss in the press cake. This is a loss that does not occur in establishments equipped with the best hydraulic presses. It is true that very heavy pressure carries through much coloring matter not withdrawn by the primitive native mill, and that the oil is consequently darker, and sooner undergoes decomposition; but modern mills are now supplied with filtration plants through which this objection is practically overcome.

The principles of the above process are daily reproduced in thousands of Filipino homes, where the hand rasping of the nut, the expression of the milky juice through coarse cloth, its subsequent boiling down in an open pan, and the final skimming off of the oil are in common practice. Notwithstanding the cheapness of labor, it is only by employing a mill well equipped with decorticating, rasping, hydraulic crushing, and steam-boiling machinery, and with facilities to convert the residue to feeding or other uses, that one may hopefully enter the field of oil manufacture in these Islands in competition with copra buyers.

COIR.

The fiber of the cocoanut husk, or coir, as it is commercially known, has never yet been utilized in this archipelago, excepting occasionally for local consumption.

Second in value only to the copra, this product has been allowed to go to waste. The rejected husks are thrown together in immense heaps, which are finally burned and the ashes, exceedingly rich in potash and phosphoric acid, are left to blow away.

As the commercial value of the fiber is greater than the manurial value of the salts therein, it is economy to utilize the fiber and purchase potash and phosphoric acid when needed to enrich the soil.

Highly improved and inexpensive power machinery for the complete and easy extraction of the fibers of the husk, either wet or dry, is now rapidly superseding the tedious hand process once in such general use. Good patterns of machinery are shown in the "husk-crushing mill" (fig. 1) and in the "fiber extractor" (fig. 2). The first breaks, crushes, and flattens out the husks by means of powerful, fluted metal rollers and, in the second the broken husks are fed over a revolving drum set with teeth especially devised for tearing out the fiber from the entire mass. Finally, it is fed into one of the many forms of "willowing" machines, which reduces the mass to clean fiber, which is now ready for grading, baling, and shipment. The residual dust and waste from this operation may be used as an absorbent for liquid manures, and ultimately returned to the plantation. The yield of fiber varies from 12 to 25 quintals of coir and 4 to 7 quintals of brush fiber per 10,000 average husks. In the Philippines the nuts yield a large amount of fiber and a relatively small percentage of chaff and dust. With improved machinery and careful handling, 18 quintals of spinning coir and 5 quintals of bristle fiber from every 10,000 husks is a fair estimate of the product.

As the cost of manufacture is generally rated at one-half the selling price, and as we must add a further charge of 20 per cent to cover freight and commission, we have resulting from the sale of the 23 quintals, or 2,300 kilos, at £16 per English ton, a balance of £11 11s. per hectare.

But there are other considerations which should not be overlooked. The husks of 10,000 cocoanuts will withdraw from the land 61.5 kilos of potash and 3 kilos of phosphoric acid, and the restoration of the full amount is called for to compensate for the growing wants of the tree, in addition to that withdrawn by the crop. The necessary fertilizers are worth, approximately, 5½d. per kilo, making a further reduction of £1 8s., and leaving as a net profit £10 3s., or, reduced to American money, nearly $50 gold per hectare.

The machines above referred to will cost $800 gold and $1,200 additional will purchase and house the power necessary to operate them. Such a plant will work up 1,000 nuts a day, and handle in a year the output of a grove of 30 hectares. With the addition of two or more fiber extractors the capacity of the plant may be doubled without material expense, and it should rather more than pay its entire cost in one year.

TUBA.

Tuba is the fresh or mildly fermented sap drawn from the inflorescence of the cocoanut.

There are no figures or data of any kind available as a basis for an estimate as to the importance of this product, but its extent may be inferred from the fact that the outlying groves about Cebu, Iloilo, and the larger Visayan towns are practically devoted to the production of tuba, and not to the manufacture of copra.

Tuba is collected from the unexpanded blossoms as soon as they have fairly pushed through the subtending bracts. To prevent any lateral expansion, the flowers are tied with strips of the green leaf blade and then, with a sharp knife, an inch or two of the extreme tip is removed. The whole flower cluster is now gently pulled forward until it arches downward. In a day or two the sap begins to drip and is then caught in a short joint of bamboo, properly secured for the purpose.

As a healthy tree develops at least one or more flowering racemes every month, and the flow of sap extends frequently over a period of two or more months, it is not uncommon to see a number of tubes in use upon one tree.

The workmen usually visit the tree twice daily to collect the liquor drawn during the preceding twelve hours in the larger tube, which he carries upon his back. He slices daily a thin shaving from the tip of the flower, in order that the wound may be kept open and bleeding. This process is kept up until nearly all of the flower cluster has been cut away, or until the sap ceases to flow.

More than a liter a day is sometimes drawn from one tree, and 5 hectoliters is considered a fair annual average from a good bearing tree.

In its fresh state tuba has a sweetish, slightly astringent taste, but, as the vessels in which it is collected are rarely cleansed, they become traps for many varieties of insects etc., and it is, therefore, not a very acceptable beverage to a delicate stomach. When purified by a mild fermentation it is far more palatable.

A secondary fermentation of tuba results in vinegar, and on this account, chiefly, so much space has been devoted to this feature of the industry. The vinegar so produced is of good strength and color, of the highest keeping qualities, and of unrivaled flavor. Its excellence is so pronounced that upon its inherent merits it would readily find a sale in the world's markets; and, although the local demand for the tuba now exceeds the production, its conversion into vinegar will probably prove the more profitable industry in the future.

Spirits are distilled and in some places sugar is still made from the flower sap; and while the importance of these great staples may not be overlooked, their commercial value as products of this tree are relatively insignificant.

MINOR USES.

In addition to eighty-three utilities described by Mr. Pereira,[a] it is in very common use in the Philippines for:

1. Cocoanut cream. The freshly ground fruit reduced to a pulp and strained is consumed in that form or made into cakes with rice. It makes a delicious and nutritious food. According to Dr. W. J. Gies, in experiments lately published,[b] its nutritive value is due to 35.4 per cent of oil, about 10 per cent of carbohydrates, and 3 per cent of protein. The amount of cellulose (fibrous matter) is only 3 per cent, and its digestibility is easy when the mass by grating is reduced to a fine degree of comminution.

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[a] Quoted in "Watts's Dict.," II, 456.

[b] Bull. Torr. Bot. Club, 1902.

2. The "milk" or water is used sparingly as a beverage. It is also fermented and converted into inferior vinegar.
3. The hard shell is used as fuel. When calcined it produces a black, lustrous substance used for dyeing leather.
4. The same shell, aside from many uses quoted by Pereira, is used here for every conceivable form of cup, ladle, scoop, and spoon.
5. From the tough midrib of the leaf strong and beautiful baskets of many designs are made, also excellent and durable brooms, and from the part where the midrib coalesces with the petiole pot-cleaning brushes are made.
6. The roots are sometimes used for chewing, as a substitute for Areca. They also furnish red dyestuff and with one end finely subdivided may be used in making toothbrushes.
7. The leaves and midribs when burned furnish an ash so rich in potash that it may be used alone in water as a substitute for soap or when a powerful detergent is required.
8. The fiber of the husk is used extensively by the natives for calking boats.
9. The milk is used in the preparation of a native dish of rice, known as "casi." It is an excellent and highly prized dietary article, prepared with rice or in combination with chicken or locusts.
10. The oil melted with resins is an effective and lasting covering for anything desired to be protected from the ravages of white ants.
11. The timber is used to bridge streams and bog holes, and the slowly decaying leaves to fill them up and render them temporarily passable.
12. The fiber is used in cordage and rope making, but to a far less extent here than in India.

Its further uses are, in general, those current in the Orient. Briefly summed up, its timber is employed in every form of house construction; its foliage in making mats, sacks, and thatches; its fruit in curry and sweetmeats; its oil for medicine, cookery, and illumination; its various juices in the manufacture of wines, spirits, sugar, and vinegar; while, not to overlook a final and not inconsiderable Filipino product, the splinters of the midrib are used in making toothpicks.

CULTIVATION.

SELECTION OF LOCATION.

In the selection of a site for a cocoanut grove it is best to select land near the seashore and not extending inland more than 2 or 3 miles. Within this narrow zone there is commonly a deposit of rich, permeable, well-drained alluvium offering soil conditions of far greater importance to successful tree growth than the mere exposure to marine influences. The success that has followed cocoanut growing in Cochin China, remote from the seaboard, in Annam, and up the Ganges basin, one hundred or more miles from the coast, and in our own interior province of Laguna, definitely proves that immediate contiguity to the sea is not essential to success.

That the cocoanut will grow and thrive upon the immediate seashore, in common with other plants, is simply an indication of its adaptability to environment. That it is at a positive disadvantage as a shore plant may be determined conclusively by anyone who will examine the root system of a seashore-grown tree upturned by a wash or tidal wave and one uprooted from any cause farther inland. It will be seen that the root system of the maritime plant is immensely larger than the other, and that a corresponding amount of energy has been expended in the search through much inert material to forage for the necessary plant food which the more favored inland species has found concentrated within a smaller zone.

The planting must be made in a thoroughly permeable soil.

The thick fleshy roots of the newly upturned palm are loaded with water and tell us that an inexhaustible store of this fluid is an indispensable element of success. If further evidence of this were required, the testimony of drooping leaves and of crops shrunken from one-half to two-thirds throughout the cocoanut districts and upon our own orchard in Mindanao, as the result of drought, confirm it and bespeak the necessity of copious water at all times.

The living tree upon the sea sands further emphasizes this necessity, for, while its roots are lapped by the tides, it never flags or wilts, and from this we may gather the added value of a site which can be irrigated. The careful observer will note that along miles of sea beach, among hundreds of trees whose roots are either in actual contact with the incoming waves, or subjected to the subterranean influence of the sea, there will never be so much as one tree growing in any beach basin which collects and holds tidal water for even a brief time, and that, notwithstanding the large number of nuts that must have found lodgment and favorable germinating influence in such places, none succeed in growing. From this we may derive the assurance that the desired water must be in motion and that land near stagnant water, or marsh land, is unsuitable to the plant.

It may frequently be observed that trees will be found growing fairly thriftily upon mounds or hummocks in places invaded by flood or other waters which, by reason of backing or damming up, have become stagnant. An examination of the roots of an overthrown tree in such a locality will show that all of those in the submerged zone have perished and rotted away, but that such is the vitality and recuperative energy of the tree that it has thrown out a new feeding system in the dryer soil of the mound immediately surrounding the stem, which has been sufficient to successfully carry on the functions of nutrition, but altogether ineffective to anchor the tree securely or to prevent its prostration before the first heavy gale.

While this phase of the question will receive more attention when we come to consider the chemistry of suitable manures, it may be said that, although analysis of the cocoanut ash derived from beach-grown nuts shows a larger percentage of those salts that abound in sea water than those grown inland, yet the equal vigor, vitality, and fruitfulness of the latter simply confirm the plant's exceptional adaptability to environment and ability to take up and decompose without detriment the salts of sea or brackish waters. As a victim to the maritime idea, the writer in 1886 planted far inland several hundred nuts in beds especially devised to reproduce littoral conditions, shore gravel, sea sand, broken shells, and salt derived from sea water being used in preparing the seed beds. The starting growth was unexcelled. Then came a long period of yellowing decline and almost suspended animation, ultimately followed by a complete restoration to health and vigor. The early excellent growth was due to the fact that the first nourishment of the plant is entirely derived from the endosperm, and careful lifting of the young plants disclosed the fact that recovery from their moribund condition was in every instance coincident with the time that the roots first succeeded in working through the unpalatable mess about them into the outlying good, sweet soil.

The exposure of the plantation is an important consideration, and a maritime site should be selected in preference to one far inland, unless it be on an open, unprotected flat, exposed to the influence of every breeze or the fiercest gales that blow.

The structure of the cocoanut seems well fitted to endure winds of almost any force, and that a remarkably abundant and strong circulation of air is essential to its best development is well shown by comparing a tree subjected to it with the wretched, spindling specimen growing in a sheltered glen or ravine.

Strong confirmation of this may be found within the artificial environment of a plant conservatory, where it is feasible to reproduce, in the minute detail of soil, water, temperature, and humidity, every essential to its welfare except a good, strong breeze. As a consequence, the palm languishes and it has long been deemed on this account one of the most rebellious subjects introduced into palm-house cultivation.

THE SOIL.

The soils for cocoanut growing are best selected by the process of exclusion. The study of the root development of the palm will prove to be an unerring guide to proper soil selection.

The roots of monocotyledons, to which great division this palm belongs, are devoid of the well-defined descending axis which is possessed by most tree plants and is often so strongly developed as to permit of rock cleavage and the withdrawal of food supplies from great depths.

The cocoanut has no such provision for its support. Its subterranean parts are simply a mat-like expanse of thick, fleshy, worm-like growths, devoid of any feeders other than those provided at the extreme tips of the relatively few roots. These roots are fleshy (not fibrous) and can not thrive in any soil through which they may not grow freely in search of sustenance. It then becomes obvious that stiff, tenacious, or waxy soils, however rich, are wholly unsuitable. All very heavy lands, or those that break up into solid, impervious lumps, and, lastly, any land underlaid near the surface with bed rocks or impervious clays or conglomerates, are naturally excluded. All other soils susceptible of proper drainage may be considered appropriate to the growth of the palm. Spons (Encyclop.) advocates light sandy soils. Simmonds (Trop. Agric.) names nine different varieties suitable for this purpose, describing each at tedious length and laying more or less emphasis upon a sandy mixture. These might all have been covered by the single word "permeable."

As a matter of fact, every grain of sand in excess of that required to secure a condition of perfect permeability is a positive disadvantage and must be paid for by a correspondingly larger area of cultivation and by future soil amendment. For the rest, the richer and deeper the soil the less the expense of maintaining soil fertility.

The preparatory work of establishing an orchard is light, provided the location is not one demanding the opening of drainage canals, and on lands of good porosity it involves neither subsoiling nor a deeper plowing than to effectually cover the sod or any minor weed growths with which it may be covered.

It has long been the reprehensible practice of cocoanut growers to merely dig pits, manure them, set the plants therein, and permit the intervening lands (except immediately about the trees) to run to weeds or jungle.

In the Philippines the native planter has not yet progressed beyond the pit stage, nor do his subsequent cultural activities include more than the occasional "boloing" of such weeds as threaten to choke and exterminate the young plants.

Fortunately it will not be long till the force and influence of example are sure to be felt by our own planters. The progressive German colonist of Kamerun, German East Africa, and the South Pacific Islands, as well as the French in Kongo and Madagascar, are vigorously practicing conventional, modern orchard methods in the treatment of their cocoanut groves, and it is amazing to read of discussions between Ceylon and Indian nut growers as to the best method of tethering cattle upon cocoanut palms in pasture, so as to obtain the most benefit from their excreta.

With an intelligent study of the plant and its characteristics it is believed that our native planter may put into practical use the knowledge that the veteran Indian planter has in fifty years failed to learn or utilize. He will learn that in time the entire superficies of his orchard will be required by the wide-spreading, surface-feeding roots of the trees, and that pasture crops of any kind, grown for any purpose other than soiling or for green manuring, are prejudicial to future success. He will know that the initial preparation of all of his orchard and its continuous maintenance in good cultivation are essential not only to the future welfare of his trees but as a necessary means in connection with a judicious intermediate crop rotation.

Hence the preparatory requirements may be summed up as such preliminary soil breaking as would be required for a corn crop in similar lands, succeeded by such superficial plowings and cultivations as would be required to raise a cotton or any other of the so-called hoed crops.

SEED SELECTION.

Preliminary to planting, the very important question of seed selection calls for close scrutiny on the planter's part.

The small native planter is often familiar with the individual characteristics of his trees. Owners of small estates in Cuyos and about Zamboanga have pointed out to me trees that have the constant fruiting habit confirmed, others that will fruit erratically, and others that flower, yet rarely bear fruit. The fruitfulness of the first class is undoubtedly a result of accidental heredity, for the planter has in the past made no selection except by chance, nor is the characteristic in any way due to his cultural system, which consists in planting the nut and letting nature and heredity do the rest. One tree in Zamboanga, the owner assured me, had never produced less than 200 nuts annually for fully twenty-three years. Asked as to the bearing of all of his trees (of which he owned some three hundred), he stated that from the lot he averaged 20 nuts at a picking, five times a year, a total of 100 nuts; that the crop of these was very fluctuating, some years falling to 60 nuts, again running as high as 130. The especially prized tree did not vary appreciably. In very dry seasons the nuts shrunk somewhat in size and the copra in weight, but the yield of nuts never fell below 200, and only once had amounted to 220. He had raised a great number of seedlings, but it had never occurred to him to select for planting the nuts from that particular tree.

PLANTING.

We have pointed out the necessity of selecting seed trees of known good bearing habits, and equal care should be exercised in selecting those the nuts of which are well formed and uniform. This precaution will suggest itself when one observes that some trees have the habit of producing a few very large nuts and many of very small and irregular size and shape, and it is obviously to the planter's interest to lend no assistance to the propagation and transmission of such traits. In view of what has been previously stated, it is almost superfluous earnestly to recommend planters to sow no seeds from young trees. The principle for this contention—that no seed should be selected except from trees of established, well-known fruiting habits—would seem to cover the ground effectually.

The best seed should be selected and picked when perfectly mature and lowered to the ground. The fall from a lofty tree not infrequently cracks the inner shell, without giving any external evidence of the injury. A seed so injured will never sprout and therefore is worthless for seed purposes.

Freshly collected seed nuts contain in the husk more moisture than is required to effect germination, and if planted in this condition decay is apt to set in before germination occurs. To avoid this the natives tie them in pairs, sling them over bamboo poles where they are exposed to the air but sheltered from the sun, and leave them until well sprouted. It is, however, more expeditious to pile the nuts up in small heaps of eight to ten nuts, in partial shade, where the surface nuts may be sprinkled occasionally to prevent complete drying out.

Germination is very erratic, sometimes occurring within a month and sometimes extending over four, five, or more months. When the young shoot or plumule has fairly thrust its way through the fibrous husk, it is a good practice to go over the heaps and segregate those that have sprouted, carefully placing them so that the growing tip be not deformed or distorted by the pressure of superincumbent nuts. When these sprouts are 30 to 50 cm. high, and a few roots have thrust through the husk, they are in the best possible condition for permanent planting.

First. The original preparation of the land should be good and the surface tilth at the time of planting irreproachable, i. e., free from weeds and so mellow that the soil can be closely and properly pressed around the roots by hand.

Second. The orchard should be securely protected from the invasion of cattle, etc. It is sometimes impossible to protect orchards against entry of these animals. If the success of these precautions can not be assured, then the nuts had better be grown in a closely protected nursery until about a year old, when the albumen of the seed will be completely assimilated and will therefore no longer attract vermin, and when the larger size of the plant will give it more protection from stray cattle.

In either case planting should be made concurrently with the opening of the rainy monsoon, during which season further field operations will not be required except when an intermittent, drier period indicates the advisability of running the cultivator.

The planting "pit" fetish, in such common use in India, has nothing to commend it. If stable manures of any kind are available, a good application at the time of planting will effect wonders in accelerating the growth of the young plants.

Where the necessary protection is assured, the young seedling planted out as above recommended should start at once, without check of any kind, into vigorous growth.

The nursery-grown subject receives an unavoidable setback. Its roots have been more or less mutilated and, as we may not prune the top sufficiently to compensate for the root injury, it is generally several months before the equilibrium of top and root is fully restored. In most cases, by the end of the second year, it will have been far outstripped in the growing race by the former.

The history, habits, and characteristics of the cocoanut tree indicate that it needs a full and free exposure to sun, air, and wind; and, as it makes a tree, under such circumstances, of wide crown expansion, these indispensables can not be secured except by very wide planting.

Conventional recommendations cover all distances, from 5 to 8 meters, with quincunx, i. e., triangular plantings, urged when the 8-meter plan is adopted. But the writer has seen too many groves spaced at this distance in good soil, with interlacing leaves and badly spindled in the desperate struggle for light, air, and sun, ever to recommend the quincunx, or any system other than the square, at distances not less than 9 meters and, in good soils, preferably 9.5 meters.

The former distance will allow for 123 and the latter 111 trees to the hectare. They should be lined out with the greatest regularity, so as to admit at all times of cross plowing and cultivation as desired.

From this time forward the treatment is one of cultural and manurial routine.

Annual plowings should not be dispensed with during the life of the plantation. These plowings may be relatively shallow, sufficient to cover under the green manures and crops that are made an indispensable condition to the continued profitable conduct of the industry. Nothing is to be gained by the removal of the earliest flowering spikes. Flowering is the congestion of sap at a special point which, if the grower could control it, he would wish to direct, in the case of young plants, to the building up of leaf and wood. Cutting the inflorescence of the cocoanut results in profuse bleeding and, unless this be checked by the use of a powerful styptic or otherwise, it is doubtful if the desired end would be accomplished. The earlier crops of nuts should all be taken with extension cutters or from ladders. No shoulders for climbing should be cut in any tree, the stem of which has not become dense, hard, and woody. Cut when the wood is the least bit succulent, they become inviting points of attack for borers.

With these reservations, there is everything to commend the practice of shouldering the tree, as offering the safest, most expeditious, and economical way of making it possible to climb and secure the harvest. It is of course understood that the cuts should be made sloping outward, so as not to collect moisture and invite decay, and no larger than is strictly necessary for the purpose.

MANURING.[a]

The manuring problem must be met and solved by the best resources at our command. The writer has had pointed out hundreds of trees that, wholly guiltless of any direct application of manure, have borne excellent crops for many successive years; but he has also seen hundreds of others in their very prime, at thirty years, which once produced a hundred select nuts per year, now producing fluctuating and uncertain crops of fifteen to thirty inferior fruits.

Time and again native growers have told me of the large and uniformly continuous crops of nuts from the trees immediately overshadowing their dwellings and, although some have attributed this to a sentimental appreciation and gratitude on the part of the palm at being made one of the family of the owner, a few were sensible enough to realize that it came of the opportunity that those particular trees had to get the manurial benefit of the household sewage and waste.

Yet, the lesson is still unlearned and, after much diligent inquiry, I have yet to find a nut grower in the Philippines who at any time (except at planting) makes direct and systematic application of manure to his trees.

In India, Ceylon, the Penang Peninsula, and Cochin China, where the tree has been cultivated for generations, the most that was ever attempted until very recently was to throw a little manure in the hole where the tree was planted, and for all future time to depend on the inferior, grass-made droppings of a few cattle tethered among the trees, to compensate for the half million or more nuts that a hectare of fairly productive trees should yield during their normal bearing life.

Upon suitable cocoanut soils—i. e., those that are light and permeable—common salt is positively injurious. In support of this contention I will state that salt in solution will break up and freely combine with lime, making equally soluble chlorides of lime which, of course, freely leach out in such a soil and carry down to unavailable depths these salts, invaluable as necessary bases to render assimilable most plant foods; and that, on this account, commercial manures containing large amounts of salt are always to be used with much discretion, owing to the danger of impoverishing the supply of necessary lime in the soil.

Finally, so injurious is the direct application of salt to the roots of most plants that the invariable custom of trained planters (who, for the sake of the potash contained, are compelled to use crude Stassfurt mineral manures, which contain large quantities of common salt) is to apply it a very considerable time before the crop is planted, in order that this deleterious agent should be well leached and washed away from the immediate field of root activity.

That the cocoanut is able to take up large quantities of salt may not be disputed. That the character of its root is such as to enable it to do so without the injury that would occur to most cultivated plants I have previously shown, while the history of the cocoanut's inland career, and the records of agricultural chemistry, both conclusively point to the fact that its presence is an incident that in no way contributes to the health, vigor, or fruitfulness of the tree.

Mr. Cochran's analysis, based upon the unit of 1,000 average nuts, weighing in the aggregate 3,125 pounds, discloses a drain upon soil fertility for that number, amounting in round numbers to—

	Pounds.
Nitrogen	8¼
Potash	17
Phosphoric acid	3

Reducing this to crop and area, and taking 60 fruits per annum per tree as a fair mean for the bearing groves in our cocoanut districts and on those rare estates where a systematic spacing of about 173 trees to the hectare has been made, we should have an annual harvest of 10,300 nuts, or, stated in round numbers, 10,000, which will exhaust each year from the soil a total of—

	Pounds.
Nitrogen	82½
Potash	170
Phosphoric acid	30

The cocoanut, therefore, while a good feeder, may not be classed with the most depleting of field crops.

To make this clear I exhibit, by way of contrast, the drafts made by a relatively good crop of two notoriously soil-improverishing crops—tobacco and corn—and, on the other hand, the drafts made by an equivalent average cotton crop—a product considered to make but light drains upon sources of soil fertility.

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[a] Throughout this paper the writer uses this word in preference to "fertilizing" even when speaking of so-called "commercial fertilizers."

A proportionate tobacco crop of 1,000 kilos per hectare will withdraw from the soil (reduced to the same standard of weights adopted by Mr. Cochran)—

	Pounds.
Nitrogen	168
Potash	213
Phosphoric acid	23

An equivalent crop of shelled corn, say, of 125 bushels per hectare, will withdraw—

	Pounds.
Nitrogen	200
Potash	135
Phosphoric acid	75

while a relative crop of lint cotton of 237 kilos (700 pounds) per hectare[a] will only exhaust, in round numbers—

	Pounds.
Nitrogen	114
Potash	70
Phosphoric acid	30

There is an analogy between these four products that makes them all comparable, in so far as all are largely surface feeders, and, as experience shows that there can be no continuing success with the last three that does not include both cultivation and manuring, we may use the analogy to infer a like indispensable necessity for the successful issue of the first.

Cultivation as a manurial factor should, therefore, not be overlooked, and all the more strongly does it become emphasized by the very difficulties that for some years to come must beset the Philippine planter in the way of procuring direct manures.

When it comes to the specific application of manures and how to make the most of our resources, we shall have to turn back to the analysis of the nut and note that, relatively to other crops, it makes small demands for nitrogen. At the same time it must not be forgotten that these chemical determinations only refer to the fruit and that, with the present incomplete data and lack of investigation of the constituent parts of root, stem, leaf, and branch, we have nothing to guide us but what we may infer from the behavior of the plant and its relationship to plants of long-deferred fruition, whose manurial wants are well understood.

It is now the most approved orchard practice to encourage an early development of leaf and branch by the liberal application of nitrogen, whose stimulant actions upon growth are conceded as the best.

In temperate regions the exigencies of climate exact that this be done with discretion and care, in order that the unduly stimulated growths may be fully ripened and matured against the approach of an inclement season. In the Tropics no such limitations exist, and the early growth of the tree may be profitably stimulated to the highest pitch. That this general treatment, as applied to young fruit trees, is specifically the one indicated in the early life of the cocoanut may be quickly learned by him who will observe the avidity with which the fleshy roots of a young cocoanut will invade, embrace, and disintegrate a piece of stable manure.

Notwithstanding lack of chemical analysis, we may not question the fact that considerable supplies of both potash and phosphoric acid are withdrawn in the building up of leaf and stem; but these are found in sufficient quantity in soils of average quality to meet the early requirements of the plant. It is only when the fruiting age is reached that demands are made, especially upon the potash, which the planter is called upon to make good.

Good cultivation, the application of a generous supply of stimulating nitrogen during its early career, and the gradual substitution in later life of manures in which potash and phosphoric acid, particularly the former, predominate, are necessary.

How, then, may we best apply the nitrogen requirements of its early life? Undoubtedly through the application of abundant supplies of stable manures, press cakes, tankage, or of such fertilizers as furnish nitrogen in combination with the large volume of humus necessary to minister to the gross appetite of the plant under consideration. But the chances are that none of these are available, and the planter must have recourse to some of the green, nitrogen-gathering manures that are always at his command.

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[a] Farmers' Bulletin 114, United States Department of Agriculture.

He must sow and plow under crops of pease, beans, or other legumes that will furnish both humus and nitrogen in excess of what they remove. Incidentally they will draw heavily upon the potash deposits of the soil, and they must all be turned back, or, if fed, every kilo of the resulting manure must be scrupulously returned. He must pay for the cultivation of the land, for the growing of crops that he turns back as manure (and that involves further expense for their growing and plowing under), and, in addition, he must be subject to such outlay for about seven years before he can begin to realize for the time and labor expended.

But there are expedients to which the planter may have recourse which, if utilized, may return every dollar of cultural outlay. By the use of a wise rotation he can not only maintain his land in a good productive condition but realize a good biennial crop that will keep the plantation from being a financial drag. The rotation that occurs to me as most promising on the average cocoanut lands of these islands would be, first, a green manure crop, followed by corn and legumes, succeeded by cotton, and then back to green manures.

To make the first green crop effective as a manure, both lime and potash are essential—the former to make available the nitrogen we hope to gather, and the potash in order to secure the largest and quickest growth of the pulse we are to raise for manurial purposes.

Both these elements are generally in good supply in our cocoanut lands; but, if there is uncertainty upon this point, both should be supplied, in some form. Fortunately, the former is cheap and abundant in most parts of the archipelago, and, when well slaked, may be freely applied with benefit, at the rate of a ton or even more to the hectare.

In default of the mineral potash salts, the grower must seek unleached wood ashes, either by burning his own unused jungle land to procure them or by purchasing them from the neighbor who has such land to burn over. If located on the littoral, he will carefully collect all the seaweed that is blown in, although in our tropical waters the huge and abundant marine algæ are mostly lacking. Such as are found, however, furnish a not inconsiderable amount of potash, and, in the extremities to which planters remote from commercial centers are driven, no source is too inconsiderable to be overlooked.

The first green crop selected will be one known to be of tropical origin which, with fair soil conditions, will not fail to give a good yield. He may with safety try any of the native rank-growing beans or cowpeas, soja, or velvet beans; or, if these are not procurable, he has at command everywhere an unstinted seed supply of *Cajanus indicus*, or of *Clitorea ternatea*, which will as well effect the desired end—to wit, a great volume of humus and a new soil supply of nitrogen. It remains for the planter to determine if the crop thus grown is to be plowed under, or if he will use it to still better advantage by partially feeding it, subject as previously stated, to an honest return to the land of all the manure resulting therefrom.

He may utilize it in any way, even to selling the resulting seed crop, provided all the remaining brush is turned back to the land and a portion of the money he receives for the seed be reinvested in high-grade potash and phosphatic manures. The plantation should now be in fair condition for a corn crop, and as a very slight shading is not prejudicial to the young palms, the corn can be planted close enough to the trees, leaving only sufficient space to admit of the free cultivation that both require.

It must not be forgotten that corn makes the most serious inroads upon our soil fertility of any of the crops in our rotation, and unless by this time the planter is prepared to feed all the grain produced to fatten swine or cattle it had better be eliminated from the rotation and peanuts substituted. In addition to this, he must still make good whatever drains the corn will have made upon this element of soil fertility.

Cropping to corn attacks the cocoanut at a new and vulnerable point, against which the careful grower must make provision. It will be remembered that an average corn crop makes very considerable drafts upon the soil supply of phosphoric acid; but if the grain is used for fattening swine, whose manure is much richer in phosphates than most farm manures, and the latter is restored to the land, serious soil impoverishment may be averted.

The next step in our suggested rotation is the cotton crop. Here, too, limitations are imposed upon the planter who is without abundant manurial resources to maintain the future integrity of his grove. He may sell the lint from his cotton, but he can not dispose of it (as is frequently done here) in the seed.

If the enterprise be not upon a scale that will justify the equipment of a mill and the manufacture of the oil, he has no alternative but to return the seed in lieu of the seed cake, wasteful and extravagant though such a process be.

The oil so returned is without manurial value and, if left in the seed, is so much money wasted. The rational process, of course, calls for the return of the press cake, either direct or in the form of manure after it has been fed. With this is also secured the hull, rich in both the potash and the phosphoric acid [a] which we now know is so essential to the future welfare of the grove.

The above rotation is simply suggested as a tentative expedient.

The ground will now be so shaded that we can not hope to raise more catch crops for harvesting, althought it may be possible during the dry season to raise a partial stand of pulses, of manure value only; but, from the fruiting stage on, this becomes a minor consideration.

This stage of the cultural story brings us once more face to face with the principle contended for at the beginning of this paper, namely, that there can be no permanent prosperity in this branch of horticulture until the crop is so worked up into its ultimate products that none of the residue of manufacture goes to waste.

At best, the return of these side products is insufficient, and, despite their careful husbandry, we can not ultimately evade a greater or less resort to inorganic manures of high cost and difficult procurement.

The residue from the press cake is rich in nitrogen and humus, which, in the ever-increasing shade of the grove, will become more and more difficult to produce there through nitrogen-making agencies; but the waste from the manufacture of coir and the ashes from the woody shell will go far toward supplying the needed potash.

Such a system would, if closely followed, practically restrict the farmer's ultimate purchases to a small quantity of acid phosphates, or of bone dust, which, in conjunction with good tillage, should serve to maintain the grove in a highly productive condition for an indefinite term of years.

IRRIGATION.

As an auxiliary manurial agent of definite well-proven value in this archipelago, I will briefly recite some of the benefits that may be expected to follow occasional irrigation during the dry season.

It strongly accelerates growth and early maturity. A few irrigated trees, reputed to be under five years from seed and already bearing fruit, were shown the writer on the island of Jolo. The growth was remarkably strong and vigorous, notwithstanding that the water of irrigation had been applied in such a way that the tree could only hope to derive a minimum of benefit from its application. It had merely been turned on from a convenient ditch whenever the soil seemed baked and dry, at intervals of one to three weeks, as circumstances seemed to require.

Irrigation, but always in connection with subsequent cultivation, may be considered equal to a crop guaranty that is not afforded so effectually by any purely cultural system.

Rarely has a better opportunity occurred to demonstrate the unquestioned benefits that have inured to these few Jolo trees from the use of irrigating waters than the present season of 1902–3. From many sources reports come to this bureau of trees failing, or dying outright, from lack of moisture. While it is true that the present dry season has had no parallel since 1885–6 and that the rainfall during the dry season has been less than half the normal, yet it should not be forgotten that, during the eight months from October to May, inclusive, the average precipitation on the west coast, at the latitude of Manila, is only about 460 millimeters and that when the amount falls below this, the cocoanut is bound to suffer.

Though it is true that the evil effects of drought may be modified, if not altogether controlled, by cultivation, the assistance of irrigation places the cultivator in an impregnable position. If evidence in support of this statement were called for, it might be found to-day in the deplorable condition of those groves that have been permitted to run to pasture, as compared with those in which some attempts have been made to bolo out the encroaching weeds and grasses.

It is probably true that, except on very sandy soils, continued surface irrigation would aggravate the superficial root-developing tendency of the tree; and to what extent, if any, occasional laceration by deep shovel tooth cultivation would injure the tree remains to be seen. There are, however, few economic plants that so quickly repair root damage as the Palmæ, and unless the seat of injury extends over a very large area, it is probable that the resulting injury would be of no consequence, as compared with the general benefits that would result from irrigation.

HARVEST.

Harvest of the crop requires but a brief discussion. The nuts should be plucked when ripe. The phenomenon of maturity can not be readily described in print. It frequently is as evident in nuts of a bright green color as in those of a golden-yellow color, and the recognition is one of those things that can only be learned by experience.

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[a] Conn. Exp. Sta. Rep. 1897, Part II.

The practice, so general in the Seychelles, of allowing the nut to hang till it falls to the ground is certainly undesirable in these islands. On the contrary, the overripe nuts will seldom fall until dislodged by a storm, and it is no uncommon thing to see nuts that have sprouted and started to grow upon trees in plantations where the harvest is left to the action of natural causes. Such nuts, of course, are entirely worthless for the manufacture of oil or copra, and even the husk has depreciated in value, the finest coirs, in fact, being derived only from the fruits that have not attained full ripeness. In any case, the nuts should be picked and the crop worked up before any considerable enlargement or swelling of the embryo occurs. From this time onward physiological changes arise which injuriously affect the quantity and quality of what is called the meat.

The heaping up of the nuts for some time after harvest favors some milk absorption, which seems to facilitate the subsequent easy extraction of the endosperm.

ENEMIES.

Outside of certain insects of the order *Coleoptera*, cocoanuts in the Philippines are reasonably free from enemies; in some districts, close to forest-clad areas, the raids of monkeys do some damage. A tree-nesting rat, which nibbles the young nuts, is also a source of considerable loss. The rat is best overcome by frequent disturbance of his quarters. This involves the removal of the dead leaves and thatch that form constantly about the base of the crown. But the wisdom of this recommendation will depend entirely upon circumstances. As the planter may find that rats or the rhinoceros beetle are the lesser evil, so should he be governed.

There are localities in the archipelago where the plague of rats is unknown and where the beetles abound. In that case it would be unwise to disturb the leaves which are very tardily deciduous and do not naturally fall till the wood beneath is hard, mature, and practically impervious to the attacks of insects.

Where rats are numerous and insects few, which is the case in some localities, the dead and dying leaves, among which the rat nests, may be advantageously cleared away whenever the tree is climbed to harvest the fruit.

Among serious insect enemies we have to contend largely with the very obnoxious black beetle, *Oryctes rhinocerus*, and, fortunately, to a lesser extent, with *Rhynchoporus ferrugineous* (probably the same as *R. ochreatus* of Eydoux), while *R. pascha* Boehm., and *Chalcosma atlas* Linn., are also said to appear occasionally.

However different their mode of attack, the general result is the same, and their presence may surely be detected by the appearance of deformed and badly misshapen or lacerated leaves.

The attacks of all species are confined to the growing point and as far downward as the wood is tender and susceptible to the action of their powerful mandibles.

The black beetle makes its attacks when fully mature, eating its way into the soft tissues and generally selecting the axil of a young leaf as the point of least resistance. Others simply deposit their eggs, which hatch out, and the resulting grub is provided with jaws powerful enough to do the same mischief. Two or three of these grubs, if undisturbed, are sufficient in time to completely riddle the growing tip, which then falls over and the tree necessarily dies.

REMEDIES.

Remedies may be described as preventive and aggressive, and by an active campaign of precaution many subsequent remedial applications can be avoided.

Most of the beetles attacking the palm are known to select heaps of decomposing rubbish and manure as their favorite (if not necessary) breeding places, and it is obviously of importance to break up and destroy such; nor can any better or more advantageous way of effecting this be suggested than by promptly spreading and plowing under all such accumulations as fast as they are made; or, if this be impracticable, by forking or turning over or otherwise disturbing the heaps until convenient to dispose of them as first suggested.

A truly preventive and simple remedy, and one that I can commend as a result of close observation, is the application of a handful or two of sharp, coarse, clean sand in the axillæ of the young leaves. The native practice is to mix this with ashes, salt, or tobacco dust; but it is questionable if the efficacy of the remedy lies so much in these additions as in the purely mechanical effect of the sand, the constant attrition of which can not be other than highly objectionable to the insect while burrowing.

Of offensive remedies, probing with a stout hooked wire is the only form of warfare carried on in these islands; but, as the channel of the borer is sometimes tortuous and deep, this is not always effective. A certain, simple, and easily applied remedy may be found in carbon bisulphid. It could be applied in the holes (which invariably trend downward) with a small metal syringe. The hole should be sealed immediately with a pinch of stiff, moist clay.

It is likely that this remedy and probing with a wire are the only successful ways of combatting the red beetle, whose grub strikes in wherever it finds a soft spot; but for these species which attack the axils of the leaves, I have great faith in the efficacy of the "sand cure," and no nut picker should go aloft unprovided with a small bamboo tube of dry, sifted sand to protect the bases of recently expanded leaves.

In Selangor cocoanut trees now come under the government inspection, and planters and owners, under penalties, are compelled to destroy these pests. Mr. L. C. Brown, of Kuala Lampur, in that State, who writes intelligently on this subject,[a] lays great stress on the value of clean cultivation in subduing beetles, and repeats a cultural axiom that never grows old and that will, consequently, bear reiteration here—that it is rarely anything but the neglected plantation that suffers, and that the maintenance at all times of a healthy, vigorous growth is in itself almost a guaranty of immunity from attacks of these pernicious insects.

While we, unfortunately, know that this is not in all cases an assured protection against diseases or insect enemies, it certainly minimizes the danger and, in itself, is a justification of the high-pressure cultural treatment advocated throughout the preceding pages.

RENOVATION OF OLD GROVES.

Material improvement of old plantations may sometimes be effected and, unless the trees are known to be upward of fifty years old, generally repays the labor. Marked increase in crop has followed a heavy thinning out of trees upon the government cocoanut farm at San Ramon, Mindanao. The improvement that a freer circulation of air and abundant sunlight have effected is very marked. Where it can be done, plowing is also sometimes feasible and should be followed by immediate crop improvement. The average native plow is not so well adapted for working over an old or neglected grove as it is for original soil preparation. It acts more as a subsoiler and will tear and lacerate more roots than is desirable. A single carabao, or one-horse American garden plow, is the better implement for this work. Extensive bat guano deposits are found in Mindoro, Guimaras, and Luzon. Some of them show richness in nitrogen and, when accessible at a moderate cost, would be useful in the renovation of old groves, where the shade would be adverse to the rearing of good crops of nitrogen gatherers.

CONCLUSION.

1. There are large areas throughout the littoral valleys of the archipelago, as yet unexploited, which, in the essentials of soil, climate, irrigation facilities, and general environment are suitable for cocoanut growing.

2. The present conditions present especially flattering attractions to cocoanut growers capable of undertaking the cultivation upon a scale of some magnitude. By cooperation small estates could combine in the common ownership of machinery, whereby the products of the grove could be converted into more profitable substances than copra.

3. The present production of copra (estimated at 278,000 piculs in 1902) is an assurance of a sufficient supply to warrant the erection of a high-class modern plant for the manufacture of the ultimate (the "butter") products of the nut. The products of such an enterprise would be increased by the certainty of a local market in the Philippines for some part of the output. The average market value of the best grades of copra in the Marseille market is $54.40 gold per English ton. The jobbing value on January 1 of this year of the refined products were, for each ton of copra:

Butter fats	$90.00
Residual soap oils	21.00
Press cake	5.20
Total	116.20

the difference representing the profit per ton, less the cost of manufacture.

4. The minimum size of a plantation on which economical application of oil and fiber preparing machinery could be made is 60 hectares.

5. There is no other horticultural tropical product which may be grown in these islands where crop assurance may be so nearly guaranteed, or natural conditions so nearly controlled by the planter who, knowing correct principles, has the facilities for applying them.

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[a] Ag. Bull. Fed. Malay States, February, 1903.

6. The natural enemies and diseases of the plant are relatively few, easily held in check by vigilance and the exercise of competent business management.

7. The labor situation is bound more seriously to affect the small planter, wholly dependent upon hand labor, than the estate conducted on a large enough scale to justify the employment of modern machinery.

8. In view of an ever-expanding demand for cocoanut products, and in the light of the foregoing conclusions, the industry, when prosecuted upon a considerable scale and subject to the requirements previously set forth, promises for many years to be one of the most profitable and desirable enterprises which command the attention of the Filipino planter.

The greatest mine of horticultural wealth which is open to the shrewd planter lies in the heaps of waste and neglected husks that he can now procure from adjoining estates for the asking and cartage.

With labor at 1 peso per diem and at the present price of potash and phosphoric acid, all the husks in excess of 300 per diem which could be hauled would be clear profit. The ashes of these, when burned and applied to the old grove, would have an immediate and revivifying influence.

Many trees in an old plantation have ceased to bear. Whether this is due to exhaustion from old age or from soil exhaustion is immaterial; each should be eradicated and the time-honored custom of replanting a fresh tree in its place abandoned. These renewals are difficult enough in any fruit or nut orchard where the scientific cultural conditions have been of the best. Renewals in a cocoanut grove, unless the vacant space is abnormally large and can be subjected to some years of soil improvement, are unprofitable.

There is a wide range of opinion as to the bearing life of a cocoanut tree. It is said to vary from thirty to one hundred and thirty years. Grown more than forty, or possibly fifty years old, the writer would hesitate to undertake the improvement or renewal of the grove.

Palms, unlike exogenous trees, afford no evidence by which their age may be determined. In general, with advanced years, come great height and great attenuation. In the open, and where fully exposed to atmospheric influences, these form an approximate criterion of age. The so-called annular scars, marking the earlier attachments of leaves, furnish no clue to age.

BULLETINS

ON THE

CULTIVATION OF HEMP, MAGUEY, JUTE, AND OTHER FIBER PLANTS

IN THE

PHILIPPINE ISLANDS.

BUREAU OF AGRICULTURE.

(Farmers' Bulletin No. 4.)

PRELIMINARY REPORT ON THE COMMERCIAL FIBERS OF THE PHILIPPINES.[a]

By JOHN W. GILMORE.

LETTER OF SUBMITTAL.

MANILA, P. I., *August 26, 1902.*

SIR: I have the honor to submit herewith the manuscript of a paper entitled "A Preliminary Report on the Commercial Fibers of the Philippines," and to recommend that it be published as a farmers' bulletin.

The paper embodies brief general information upon the fibers which are at present exported from the Philippines, and also upon the most important of those which enter into the interisland trade and have a large and important use among the natives. The illustrations are from photographs taken by Mr. C. W. Dorsey, soil physicist.

Respectfully,

JOHN W. GILMORE,
Expert in Charge of Fiber Investigations.

Prof. F. LAMSON-SCRIBNER,
Chief Insular Bureau of Agriculture.

INTRODUCTION.

It is the object of this paper to set forth briefly some facts regarding the fiber plants and their products of the Philippine Archipelago which are at the present time receiving commercial attention. It is not now practicable to mention all those which are of economic importance; for, as this is one line of work which this bureau is taking up, treatment of such plants and their fibers will be reserved for later publications.

Strictly speaking, Manila hemp and maguey are the only raw fibers exported from these islands at the present time, and of these the former rank among the economic products of the archipelago. The production and exportation of Manila hemp is indeed the most important industry of the islands at the present time, both from a financial and a commercial point of view. Almost every ship that makes a trip to the south of Manila brings back a consignment of Manila hemp, which in turn is loaded into regular hemp-carrying steamers for American and European ports. Formerly the fiber was shipped to Manila, but during the past two years ocean-going vessels have loaded in Cebu with full cargoes for foreign ports.

Manila hemp came into notice in the early part of last century, but it was not recognized as a product of importance until about 1850. The following table shows the growth in production by decades:

	Tons.		Tons.
1840	8,502	1880	50,482
1850	8,561	1890	67,864
1860	30,388	1900	89,438
1870	31,426		

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[a] The following illustrations accompanying this report are on file in the War Department:

Plate I. A field of abacá protected by numerous shade trees, Sorsogon Province, Luzon.

Plate II. Laborer's house surrounded by abacá plants, Mount Iriga, Camarines Sur, Luzon.

Plate III. Unloading loosely bound bundles of abacá fiber from sailing vessels and spreading it to dry in front of large warehouses, Tacloban, Leyte.

Plate IV. Drying extracted abacá fiber, Sorsogon Province, Luzon.

As a product of value Manila hemp ranks first among the resources of the islands. During the fiscal year 1901 the total value of all exports from the islands was $23,197,367, and of this amount $14,453,110 represents the value of hemp, which is 62.3 per cent. Its relation in this regard to other products of the islands is shown in the following table, which gives values for the fiscal year 1901:

Article.	Amount.	Per cent of total exports.
Manila hemp	$14,453,110	62.3
Copra and cocoanuts	2,663,340	11.47
Sugar	2,293,075	9.88
Tobacco, cigars, and cigarettes	2,217,728	9.56
Coffee	6,616	.02

Cotton, pineapple fiber, and ramie are produced in the Philippines, but for the present they have dropped from the articles of export. They are used in the economy of the natives, and, with the exception of pineapple fiber, large quantities are imported.

The other products mentioned, pandan, burri, nipa, and rattan, are used more or less extensively throughout the islands, and in some instances form articles of trade between island ports. All of these are extremely useful to the natives. Pandan and burri are used extensively in the fabrication of hats, mats, and coarse weavings. Nipa is used, wherever it can be obtained, for the roofs and sides of dwellings, and the rattan is a substitute for nails and pins in the construction of houses, a serviceable article for lashings and bindings, and is used extensively in furniture making.

As a whole the fibers and fiber products of the Philippines form an important source of wealth to the islands, and at present the attention given to their economic production and preparation for market is inappreciable. It is believed that, by enlarging the fiber-producing area, by improving the present methods of cultivation and preparation for market, and by introducing such new fiber plants as would be adapted to the climatic and labor conditions of the islands the fiber interests will easily retain their rank with the leading resources of the islands.

MANILA HEMP OR ABACA.

This fiber, so well known in commerce, is produced by a species of the banana family (*Musa textilis*). *Musa* is quite a large and specialized genus, and some of the species comprise several varieties. Among the Filipinos the genus is divided into three groups—the plants which produce the edible banana of commerce (Visaya, saging); those which produce the fiber under consideration (abaca); and the wild banana (pacol), which has no recognized economic value. The plants of all these species produce a fiber of greater or less strength, and in tropical countries where the plants grow the fiber generally finds some use in the economy of the natives.

The name, "Manila hemp," by which the fiber under consideration is known, is a misnomer. Properly speaking, hemp is the product of another plant, *Cannabis sativa*, a native of western and central Asia, and it is a bast fiber or the fiber of the inner bark. But the Manila hemp is a structural fiber; that is, it forms a part of the structural system of the leaf sheath. Nearly all fibers first came into notice through their commercial uses, and as commerce and utility do not stop to inquire into scientific relationships, each fiber, as it came into extensive use, began to be known as hemp, qualified by a word signifying the place from which it came or the use to which it was put. Thus we have Manila hemp, Bowstring hemp, Bombay hemp, Calcutta hemp, Pita hemp, water hemp, and many others. However, since the name "Manila hemp" is so well established it would not be wise to attempt to change it.

Although the various species of the genus *Musa* flourish in nearly all tropical countries of the world, yet *Musa textilis*, from which the manila hemp is obtained, seems to thrive to the best advantage only in the Philippines. Attempts have been made to introduce it into other countries where other species closely related grow, but these attempts have not been successful. The species was introduced into Calcutta in 1822 and into Madras in 1859. While the plants of these introductions produced fiber, yet it was of an inferior quality, and the cost of production exceeded the value. In 1873 the plant was introduced into the Andaman Islands. These trials were more successful than those in India, the best fiber being of about the same quality as the medium from the Philippines. Attempts have also been made to introduce the plant into Florida and the West Indies, but with unsuccessful results.

SOIL AND CULTIVATION.

Musa textilis requires a uniformly moist and warm climate for its best growth and development. While it may be found almost throughout the entire archipelago, yet it grows to the best advantage in the provinces of Albay, Camarines Norte and Sur, Sorsogon, and in the islands of Masbate, Mindoro, Marinduque, Samar, Leyte, Cebu, southern Negros, and parts of Mindanao. In these regions there is an abundant rainfall and a high relative humidity of the atmosphere. The following table gives a general idea of the annual rainfall and average temperature of these regions:

Province.	Number of years averaged.	Temperature.	Days rain.	Rainfall.
		° *C.*		*Inches.*
Albay	6	26.05	218.5	118.42
La Carlota (Negros)	10	26.5	154.3	103.65
Mamburao (Mindoro)	2		147.5	124.65
Zamboanga	2	27.12	110	35.44
Iloilo	4		152.6	71.84
Cebu	6		161	58.88
Tamontaca (southern Mindanao)	2		121.3	76.38
Davao	2		187	79.82

The relative humidity of the atmosphere also has an important bearing upon the growth and development of *Musa textilis*, but as a general rule in the Philippines the relative humidity follows the rainfall in its variations, and during the entire rainy season there are many days of excessive humidity when there is no actual rainfall, and so far as the effect on the growth of the plant is concerned, these would have almost the same effect as seasons of rain.

In selecting a site for a plantation four considerations are to be borne in mind—the rainfall, the humidity of the atmosphere, the soil in particular reference to exposure and drainage, and protection from excessive sun and wind. Sufficient has been shown in the table above to indicate the necessity of an abundant rainfall and high relative humidity of the atmosphere. These characteristics of any situation to be devoted to *Musa textilis* insure a more vigorous development of the plant and consequently a greater production and a better quality of fiber. But it must not be supposed that the plant requires a wet soil. Moisture is what it demands and not water. The plant will not thrive in marshy land, no matter what the rainfall and protection from wind and sun may be. In its natural choosing the plant selects the well-drained mountain slopes and the sloping valleys lying between their spurs. In these situations sufficient trees grow or are left to grow to protect the fiber plants from the fullest rays of the sun and from the strong winds. In addition to this, the soil is naturally well drained, is rich in humus, and in such places there are usually washings and other movements of the soil sufficient to answer for a sort of cultivation.

In many sections even where rainfall is sufficient much land could be profitably devoted to the growing of *Musa textilis* and the production of Manila hemp by giving the land sufficient drainage. Drainage by surface ditches is one method which might be practiced. It is not the most practical method, but under the present conditions of labor and the difficulty of obtaining tiles it can be made to serve broad purposes. This method has another point favoring it, in that the ditches can be made between every other row, and as the rows are wide enough apart, the ditches will not materially interfere with the crop. This method is almost exclusively followed by the coffee growers in Java and the tea growers in Asam and India. But looking forward to better labor conditions, a greater development of the hemp industry, and the perfection of the means for making drain tiles here in the islands, for which there is abundant material, drainage by underground conduits is the most practicable, and, in the end, the cheapest method of draining land.

The cultivation of *Musa textilis* is not a difficult matter; though judicious care and shading will bring good harvests. The plants are set in rows from 5 to 8 feet each way, and until they reach maturity it is necessary to keep the weeds in subjection. The plants reach maturity in from two and one-half to three and one-half years, when they are usually left to themselves with the exception that coarse weeds are kept out. It is quite necessary that the ground be kept covered with some herbage, for the land is usually so rolling that otherwise washing would do much damage. No better scheme could be employed, either on rolling or level land, than that of sowing in the plantation some of the clovers or other leguminous crops that grow well in the Philippines, which would not only bind the soil to prevent washing, but would add to the soil a most useful element, nitrogen. In most situations trees are either left growing in the plantations or are afterwards planted for the purpose of shading the plants to some extent from the glaring rays of the sun and to break the force of the winds which would tear the leaves to pieces and retard the development of the plant. This is especially desirable on young plantations. These trees, however, should have small leaves in order that a dark shade may not be produced, and they should have deep feeding roots in order that the fiber plants be not robbed of their plant food.

In the Philippines no systematic attempt has been made to determine the best tree for this purpose. In most localities the best tree nearest at hand is left growing or is planted. Members of the genera *Erythrina* and *Sterculia* are perhaps more used than others, and it is suggested that the *Pithecolobium*, a tree extensively planted because of its shade, might answer the purpose.

It is said that these trees are primarily for the purpose of shade, but if they possess the proper deep-feeding qualities they serve not only the purpose of shade and the conserving of moisture in the upper layers of soil, but as wind-breaks also. From the nature of the structure of all banana leaves these plants are very poorly adapted to withstand the force of strong winds. In such winds the leaves are soon torn into shreds, and hence their function as assimilators of plant food is very much diminished. Therefore the necessity of choosing situations as free as possible from strong unobstructed winds.

Unlike many of the edible bananas, *Musa textilis* produces seed-bearing fruits. These seeds may be planted for the reproduction of new plants, but except where very extensive plantings are wanted a better method is to plant the small suckers which spring from the root of the parent plant. After the plantation has reached its maturity and harvesting is in process the old plants are cut near the roots and the suckers are left to grow up. After the plants reach maturity, the crop is constantly renewing itself so that harvesting can go on almost continuously. The plant is in the best condition for producing fiber about the time the flower bud reaches the top of the plant. The stalk is then cut as near the root as possible and the leaf sheaths are stripped off. The fiber is the so-called fibro-vascular bundles which make up part of the structural substance of the leaf sheath surrounding the flower stem from the ground to the expansion of the leaves. The length of the leaf sheath determines to some extent the length of the fiber. This leaf sheath is thicker along the center than it is at the sides, and in order to facilitate the stripping of the fiber it is split longitudinally into strips 2 to 3 inches wide. The strips from the thicker portion of the sheath are then torn tangentially, inasmuch as the fiber is contained mainly in the outer part of the sheath, and the inner portion of the thick strips which are torn off consist mainly of the valueless pulp.

EXTRACTION OF FIBER.

For stripping the fiber the method almost universally in use is to draw these prepared strips between the edge of a knife or bolo and a hard, smooth block. The apparatus can be set up at frequent intervals in the vicinity of the plants to be cut. A nipa shed is constructed, though sometimes the protection and shade of a large tree is chosen. To two uprights set in the ground a horizontal pole is attached with "bejucos" or rattan canes. A short, strong knife or bolo with a wooden handle is firmly attached on a pivot or fulcrum upon the upper surface of the horizontal pole. The handle is attached by a rattan cane to a bamboo spring arranged in the roof of the shed or to a branch of the tree, while another rattan cane runs from the handle to a treadle on the ground which can be worked by the foot of the operator. The spring in the roof above holds the knife upon the pole, or in some cases a block, with a uniform pressure while the strip of the leaf sheath is being drawn between its edge and the pole or block. By placing the foot upon the treadle the pressure is released and the fiber may be redrawn or a new strip inserted.

When it is not the desire of the operator to produce a fiber of fine texture and white color a knife with finely serrated edge may be used. By using a knife of this kind there is less waste of the fiber, but at the same time more of the undesirable pulp and, consequently, fresh juice is left with the fiber. This residue of pulp and juice drying upon the fiber gives it an undesirable color, and if too much is left on the strength of the fiber is injured and the market value is much reduced. The whitest fiber is drawn under a knife with a smooth edge and immediately after the plant is cut. If the stalks and strips are allowed to lie in the sun for any length of time before the fiber is drawn the fiber will be colored more or less yellow. As a means of increasing the fineness and whiteness of the fiber the strips may be drawn several times when they are fresh. Of course the greater the number of times the fiber is drawn and the greater the pressure upon the knife the more is the waste, but the increased value of white fiber will compensate for a certain amount of waste.

In yield *Musa textilis* varies considerably. In Albay, Sorsogon, and Masbate, where the rainfall is heavy and the humidity of the atmosphere is high, the yield ranges from 12 to 16 piculs of dry fiber per hectare each year (687.5 to 967.6 pounds per acre). In other provinces where the climate is dryer the yield may not exceed 6 piculs per hectare. In some localities the quality of the fiber is injured by the work of borers. Wherever these insects work the fiber is either cut entirely or it is injured in color and strength.

Several attempts have been made to perfect machines for extracting this fiber economically, but these machines have either fallen far short of their requirements or have not met with favor among the natives who have had occasion to use them. The most essential feature at the present time of a machine for this work is that it be light and portable. The greater part of Manila hemp is produced on the mountain or volcano sides or on very rough ground, and as the plant stalks are quite heavy all planters have found it most economical to transport their apparatus rather than the material. It is hoped, however, that some apparatus can be devised to avoid the great waste which renders the present method objectionable. It is variously estimated that from 20 to 30 per cent of the fiber is wasted by this crude process of drawing, and this fiber, too, is fine and of good quality. The thought is at once suggested that this waste fiber might be used as a paper stock if it is not too much injured by the juice and pulp with which it is mixed and if it can be economically separated from them. This is a line of investigation which will be subsequently taken up.

CLASSIFICATION AND USES.

For commercial purposes the fiber is classified into several groups according to color, texture, and strength. Length plays a less important part in the commercial grades. The great lightness, combined with strength, is the characteristic of this fiber which gives it its great value. The qualities usually recognized are the superior, current, second, and red. Then there are numerous gradations in each of these groups. The fiber for export is usually tied in small wisps or hanks, and these are put up in bales weighing 2 piculs (275 pounds).

In all countries to which this fiber is exported the greater part of it is used for cordage and ropes. In the United States immense quantities are made into binder twine, and because of its lightness, strength, and comparative durability it is very serviceable for ship's ropes and cables. From old and disintegrated ropes our valuable manila paper is made. In the Philippines the finer qualities are used in the manufacture of textile fabrics. Throughout the entire archipelago these weavings are worn extensively by both men and women, and when the fiber is mixed with cotton a durable fabric is produced, which is well adapted to the climatic conditions of the islands. It is believed that the demand for the better qualities of these fabrics will increase in the United States and Europe. A small use is made of the fiber in upholstery, packing, and brush making.

Enough has been said in the general statement above to show the commercial importance of this fiber and the quantities which are being consumed. It may be that, as the wood pulp now being used so extensively for the cheaper grades of paper becomes more scarce, certain qualities of the Manila hemp may take its place.

MAGUEY.

Maguey is a name usually given to the various varieties of *Agave americana*, or century plant, but sometimes, as here in the Philippines, the same name is applied to the fiber of these plants also. The name is in general use in Mexico and Central America, where the varieties of this species grow most abundantly, but it is often used also to refer to any species of agave or its fiber growing in a particular locality.

This plant has a rugged, hardy appearance which is in harmony with the dry climate and stony or sandy soil conditions in which it is most usually found. During the greater part of its life, which varies from eight to twenty years, it is without a stem, having a rosette of twenty to forty strong, fleshly leaves rising from the ground. These leaves bear spines along the edges and the ends are hardened into a strong, horny point. The leaves are from 3 to 7 feet long, and are made up of hard, pulpy material through which the fibers run as vascular bundles for conveying the sap. Except in the variegated variety, the leaves are light green with a whitish powdery covering or bloom. When the plant is of mature age, its flower stalk grows up very rapidly, sometimes to the height of 15 feet. The plant flowers only once and then dies; however, it produces both seed and suckers as means of reproduction.

Nearly all of the agaves produce fiber, and many of them are of commercial importance. Notable among the commercial fibers are maguey, sisal, and ixtle, or Tampico fiber, produced by different species of agave and their varieties. The *Agave americana* in Mexico and Central America is quite extensively grown for the production of the intoxicating beverages pulque and mescal, and for soap. The aggregate of all fibers produced by these plants is a large item in the world's output of fibers. In 1891 about 80,000 tons of raw fiber, valued at about $9,000,000, entered the United States alone.

CULTIVATION.

In the Philippines maguey, *Agave americana*, is cultivated in the islands of Panay, Cebu, Mactan, and in the northern provinces of Luzon, notably in Zambales, Union, and Ilocos Sur. The plant has been introduced into these islands from Mexico or Central America, as in all parts where it is culitvated it bears its Mexican name, maguey, or slight variations. P. Delgado, who wrote about 1775, says that it is not indigenous, but no note is given as to when and by whom it was introduced.

As stated above, these plants will grow in soils varying widely in texture and content of moitsure. In many places, indeed, they thrive under conditions unsuitable to any other crop. Their long fleshy leaves render them capable of withstanding long droughts. They are not, however, averse to the rich soils and humid climate of the Philippines; in the more humid climates, indeed, a longer and more elastic fiber is obtained.

In no country where these plants grow have they received much care in cultivation. Unless planted very far apart they can not be cultivated by draft animals because of the strong sharp spines which tip the leaves. In general practice they are planted in rows 8 feet apart and 6 feet apart in the row, though in Mexico it is said that they are planted only 3 feet apart each way, and when the leaves grow long they are tied up. However, about the only cultivation they receive is weeding. The leaves reach maturity in about three years. From this time until the plant flowers, which varies from twelve to thirty years, the leaves are harvested as they reach maturity. Each plant will yield about twenty-five leaves a year, which, in turn, produce about 1½ pounds of dry fiber. This is not a very great yield in comparison with Manila hemp, but the fact that the plant accepts climatic conditions which would not be tolerated by any other plant renders it an economic product.

As the plant reaches maturity, suckers may grow out from the axils of the lower leaves. These are best for reproduction, as they are large enough by the time the plant dies to take its place. However, as a general rule they are not produced in sufficient abundance to supply the need of large plantations. The plant does not produce seed abundantly, but upon the flower spikelets are borne numerous small slips or suckers, which fall to the ground as the stem ripens. The flowering usually takes place during the dry months, and these little slips may be collected and set out in rows 1 foot apart and 6 inches apart in the row until they take root. They do not need watering or shading, as they are extremely hardy. They can be shipped long distances if kept dry. New plantations are started and old ones are renewed by propagating these slips. The seeds are only used for the production of new species.

EXTRACTION OF FIBER AND YIELD.

The method of extracting the fiber varies somewhat in different localities, but the essential principles are the same—that is, maceration in water (sometimes in salt water), then rubbing and scraping. Oftentimes the leaves are gathered and crushed or beaten and then piled in bundles to ferment. When fermentation has ceased, the masses are thrown into water until the pulpy material has further deteriorated, when the crushed leaves are separated, rubbed, and scraped, and then put out to dry. In other instances the leaves are thrown into the water without being crushed and fermented, but by this method the fiber is much damaged because the leaves are so thick and impenetrable that the whole mass partially rots.

The fiber extracted is fine and soft, having a wavy appearance, which renders a bunch more fluffy than a similar bunch of Manila hemp or sisal. Its whiteness depends largely upon the method and care in extracting it. If produced in accordance with the best method, it is quite white and brilliant. Another characteristic of this fiber is its elasticity, which renders it adaptable for ropes and cordage for uses where sudden strains are expected

Although the plant is quite widely distributed throughout the archipelago, yet the fiber is not produced for export on a very large scale. During 1901 there was shipped from Manila, the only port from which the fiber is exported, 875 tons (2,240 pounds each), valued at about $100 per ton, and for the past six months of this year 867 tons have already been shipped, while for the same period last year (1901) only 562.5 tons were shipped. This would show a decided increase for this year, and in connection with the figures it must be stated that this fiber is almost all marketed before the beginning of the rainy season.

The fiber is used very largely in Europe and the countries of both North and South America for making ship's ropes and cables and for ropes in mines, for lines, nets, and weavings for hammocks. In Mexico it is extensively used for saddle cloths. The cloths are not woven, but matted and stitched. It is used also in upholstery.

A number of machines have for several years been used extensively in Mexico and

Central America and the West Indies for extracting sisal fiber from *Agave sisalana*. This plant, though producing a coarser fiber than the maguey, is so nearly like it in the size and texture of its leaves that no doubt some of these machines could be adapted to extract the maguey fiber. These machines vary much in capacity, cleaning from 75,000 to 120,000 leaves per day. The essential principle of these machines is that the pulpy material is scraped from the fiber without being fermented or macerated, thus saving considerable time and labor.

PINEAPPLE FIBER.

(*Ananas sativus.*)

Few of our economic plants have become more widely disseminated since their discovery than the pineapple. It is, to the best of our knowledge, a native of Brazil, and was first introduced into Europe in 1513. Now it is grown in nearly all tropical and subtropical countries. In nearly all countries where the plant is of economic importance it is cultivated for its delicious fruit, but at the same time the leaves produce a fiber which for fineness and comparative strength is not equaled by any other vegetable fiber. The value of this fiber has long been known to natives of countries where the plant flourishes for its strength, fineness, and durability in water. It has long been used in India and China for lines and thread and as an adulterant in silk and woolen fabrics. Pineapples are grown quite extensively in Singapore, mainly for their fruit, but some fiber is produced for export to China, where it is used for thread and woven into cloth.

The pineapple is quite extensively distributed throughout the Philippines. In some places it grows wild; in others it is cultivated, or rather husbanded, for its fruits. In the Luzon provinces of Laguna, Tayabas, Ambos Camarines, and Albay, throughout the island of Panay, and to some extent in Cebu, it is grown for the production of fiber. It is claimed by Mr. Perouttel that the pineapple grown in the Philippines is a distinct species which he calls *Bromelia pigna*, but sufficient material has not been collected by us to verify this. However, in many parts, either because it is a different species, or because of climatic conditions, the plant can hardly be praised for its fruit-bearing qualities. The fruits of these are small, fibrous, and not easily digestible. There are localities, however, where fruits of superior quality are produced.

Ananas sativus will flourish on soils varying greatly in texture and fertility. It is particular, however, that the soil in which it grows be well drained and porous. In the Florida Keys it produces profitable crops upon soils not more than an inch thick covering the coral rock, and analyses of good pineapple soils show very small percentages of the food elements essential to plants. The pineapple plant is capable of withstanding long droughts. However, if the soil is porous and well drained, it will adapt itself to the more humid climates where rainfall is abundant.

The pineapple produces seed, but it requires, according to Weber, from ten to twelve years to mature plants from these. The best method of reproduction is by replanting the suckers which grow out from the parent plant near the ground. The plant may also be propagated by crowns, slips, and suckers. These are slow to mature. Besides, the crowns are usually left on the fruit, and the rattons are left to take the place of the old plant. When the pineapple is propagated by the buds in the axils of the leaves it requires a year or a year and a half longer for the plants to reach maturity. In preparing land for a pineapple plantation it is well to remove all stumps, brush, and weeds, and plow deeply. If the subsoil is hard and has a tendency to hold water, the land should be subsoiled. The rainfall in the Philippines is so heavy that drainage, either by surface ditches or by underground conduits, should be provided. This is quite essential, for the plants will not thrive in a wet soil.

As a general rule but light surface cultivation is all that is needed, and in such cases the plants are set from 30 to 36 inches apart in rows each way. In localities where the climatic and soil conditions require deeper and more thorough cultivation, they may be planted 30 inches apart in the row and the rows 4½ to 5 feet apart. This practice is followed in the Hawaiian Islands. Pineapple plantations should not be exposed to strong winds, as the leaves are easily chafed or broken, and this, in turn, diminishes the yield and quality of the fiber.

The plants from suckers will produce mature leaves in from nine months to a year. When pineapple plants are grown for fruit the quality is much improved by judicious fertilizing.

EXTRACTION OF FIBER AND USES.

In the provinces of the Philippines, where the plants are grown for fiber, the fruit is cut shortly after flowering, in order that the leaves may develop more fully. When the leaves are mature they must be cut before they become old and worked as soon as possible after cutting. The fiber is so fine that it can not be separated from the pulp when the leaves are old and dry. As in the extraction of Manila hemp and maguey, the pineapple fiber is also extracted in a simple and primitive way. The fiber is too light and fine to admit of being drawn as Manila hemp is drawn, so the natives in southern Luzon and Panay resort to a method of scraping. The freshly cut leaves are spread upon a narrow bench, and with light short strokes of an iron scraper, the edge of which is not too sharp, the epidermis is scaped off. Sometimes a bamboo or wooden scraper is used, and while this method is slower, yet there is less waste, and a softer quality of fiber is produced. This exposes a layer of fiber which is lifted by the fingers or a small spatula. The scraping is then continued until another layer of fiber is exposed, and this in turn is lifted away. The process continues until all the fibers of the leaf are separated out. As the fiber is separated it is washed in clear water, and laid out in the sun to dry and bleach. The washing and drying may be repeated until the fiber possesses the texture and whiteness desired.

A mature plant has about 40 leaves from 1½ to 3 inches broad and ranging from 2 to 5 feet long. In the provinces of Iloilo and Antique, where pineapple plants are grown largely for their fiber, a ton of leaves, about 22,000, produces from 50 to 65 pounds of dry fiber. This is a small yield when we take into consideration the number of leaves which have to be handled and the labor of extracting the fiber. Before the pineapple fiber can become a very important commercial product machines will have to be devised for extracting the fiber on plantations more extensive than those worked at present. Two machines have been used, the Van Buren and the Sanford Mallory, but they have not yet been able to produce a quantity of fiber sufficient to make their use economical.

The pineapple fiber has not yet been produced in quantities sufficient to give it commercial importance. But no doubt it is destined to a more extensive use than at present, as it possesses unique qualities. The fabrics called "piña" and "rengue," manufactured from it here in the Philippines, are constantly becoming more popular in both Europe and America, and there is a growing demand for these fabrics for embroidery. The rengue and piña are now valued at from 25 to 75 cents per yard, and the fiber in the London market has been adjudged worth £30 per ton.

The fiber is also used for small cordage where great strength is required. In Calcutta a rope 3¼ inches in circumference was tested and bore a strain of 5,700 pounds. It has been suggested that the dried leaves from the fruit plantations could be used for paper stock, but as yet no trials along this line have been made.

COTTON.

There is hardly an intelligent person in the world who is not acquainted with cotton as a fiber, and to both the student and general reader it would seem only necessary to refer to the many excellent books and papers which have already been written upon this subject. Among the most recent books is Bulletin 33, United States Department of Agriculture, Office of Experiment Stations. This work discusses at length the history, botany, chemistry, cultivation, and varities of cotton.

The influence of cotton upon the commercial and social interests of the people of the world is far reaching. Cotton and its products form one of the greatest items, both in tonnage and value, in the carrying trade of the world. What the bamboo and cocoanut are to people of the Tropics cotton is to people of the world in even a broader and a larger sense, and it is almost unique in the sense that the variety of its products, and their usefulness and beauty are more perfectly wrought by the use of machinery. The growth in the quantity of cotton consumed and the development of the cotton industries during the past century have been most striking. This growth is due primarily to the invention of the cotton gin in 1793, which made it possible for the fiber to take its place as an essential in the economy of mankind. During the first decade of the nineteenth century the production reached 300,000 bales. The production then gradually increased during the next forty years until more than 2,000,000 bales were produced, while at the present time more than 13,000,000 bales are required to supply the world's demand.

The cotton plant is a member of the Malvaceæ or mallow family. It belongs to the genus *Gossypium*, of which there are a number of species. These plants have been cultivated for so many hundreds of years, and hence are so subject to modification by climatic and soil influences, that it is very difficult to determine the type of the species and varieties. Among the recognized species of economic importance are *G. herbaceum*, *G. barbadense*, *G. brasiliense*, and *G. arboreum*. *G. herbaceum*, with its varieties, is the species most extensively cultivated in the United States, where it grows as far north as latitude 36°. The staple of this cotton is not so long and soft as the Sea Island kinds, but because of its adaptability to the soil and climate of the United States it contributes more largely to the quantity and value of the world's product than any other species. The well-known Sea Island cotton is included in the *G. barbadense* and its varieties. This kind produces a longer staple than perhaps any other economic species, but the yield is less and it is more limited in its geographical distribution. The plant flourishes south of latitude 26° N., and as a general rule requires a humid climate, though irrigation will sometimes compensate for this. The famous Egyptian cotton belongs to this class.

The other two species mentioned, *G. arboreum* and *G. brasiliense,* are for the most part inhabitants of tropical countries and are of lesser economic importance than the preceding. *G. arboreum,* however, with its variety *neglectum* is planted in India and forms the Decca and Bengal cotton of commerce. The fiber of these varieties is generally long and fine, but the yield is not large. All species of cotton are naturally perennials, but in cultivation they are sometimes annuals or biennials. They grow as perennials in most of the islands of the Philippines, where they are flowering and fruiting nearly all the year round.

Unlike the fibers previously considered, the cotton is what we call a surface fiber; that is, it is the unicellular filaments growing upon the surface of the seeds, and not entering into the structural substance of the plant. The staple of the different varieties of cotton varies. The average length of the Sea Island varieties is 1.65 inches, and that of the Brasilian 1.25 inches, that of the herbaceous varieties 1.10 inches, and that of the arboreum 0.9 inch. When the cotton fiber is ripe each filament has a flattened, twisted appearance, and the wall is much thicker in proportion to the size of the cavity than in the green filaments. Cotton should be not be picked until the bolls have ripened and the lint thoroughly dried in the sun.

Gossypium herbaceum and its varieties is the species most usually cultivated in the Philippines for its fiber, although *G. arboreum* occurs. The former species is grown more or less extensively in the provinces of Ilocos, Union, Pangasinan, Abra, Bulacan, Batangas, Camarines, and Laguna and in the islands of Panay and Cebu and parts of Mindanao.

Although cotton is grown throughout a large area in the Philippines, yet the fiber has never been produced in sufficient quantities for foreign export. Some years ago a small interisland trade existed, but the coming of cheap cotton prints and yarn from Europe, India, and China has caused a decrease in both the production and trade between ports. The production for 1893 in some of the northern provinces of Luzon is shown in the following table:

Province.	Area.	Total production.	Kilograms per hectare.
	Hectares.		
Ilocos Norte	362	103,349	396
Ilocos Sur	60	21,678	359
Abra	9	2,953	321
Union	177	68,159	384
Pangasinan	17	5,528	312

The average is 354 kilograms per hectare, or 315 pounds of lint cotton per acre. Yet this is not the average of production in the islands. It is safe to say that the average is not more than 165 pounds of lint cotton per acre.

The production of raw cotton or of cotton manufactures on a commercial scale is inseparable from the use of machinery. The employment of cotton in weaving dates back into the centuries before Christ, but if it had not been for the invention of the cotton gin perhaps the fiber would not be as much used to-day as it was then. The perfection of weaving machinery has greatly extended the value and usefulness of this fiber. Two machines have been used for the separation of lint from the seed from time immemorial in China and India. The most simple and probably the oldest consists of a piece of iron in the form of a double cone, large in the center and tapering toward ends (sometimes a simple cone is used). For its use the seed cotton is spread upon a flat stone or heavy board, and this cone, used as a roller, pushes the seed from the lint as it revolves. A little pressure may be exerted by the hands or feet of the operator. This implement can be used only with the naked and hard-seeded varieties. By this method only from 4 to 6 pounds of lint cotton per day can be turned out by each operator. The other of these which has found its way into the Philippines, probably through China, consists of two wooden rollers arranged horizontally one above the other (sometimes the lower one is of iron), and the lower one is usually smaller than the upper. The lower roller is turned by a foot treadle and the upper one by one hand while the cotton is fed into them by the other. The revolving rollers draw the lint away from the seeds. By this method from 6 to 8 pounds of lint cotton can be separated per day. In many of the cotton-growing districts of the Philippines, however, the lint is separated from the seed by hand.

SOIL AND CLIMATIC CONDITIONS.

Climatic conditions have a greater influence over the production of cotton than do soil conditions. The plant will grow in almost any soil of good texture and fertility. Cotton is a deep-feeding plant, and arable soils which are sufficiently loose and deep to give the roots a free growth and which are not soaked with water will be likely to produce well.

Throughout the archipelago the conditions of rainfall and temperature have a greater effect upon the cotton crop than does the soil. The land in which the seeds are planted should be warm and moist. A cold, wet soil will be almost sure to rot the seeds. Therefore the seeds should germinate and the plants begin to obtain their food from the soil between rains, if possible. After this and during the growing period the rains may be frequent, provided the land is drained, without serious detriment to the crop. from the time the bolls begin to set until the crop is harvested a dryer atmosphere, with a greater variation between the day and night temperature, will be of great advantage. Rains during the season of ripening are prejudicial to the crop, as the falling rain knocks the cotton from the bolls and the color and quality of the fiber is damaged. The cotton plant demands a large amount of sunshine, especially during the latter period of its growth.

In preparing the land for cotton hard and compact soils should be plowed deeply enough to facilitate penetration by the roots. It must be remembered, however, that deep plowing may result in the disadvantage of heavy leaching, or, in a few localities, the turning of sterile soil to the surface.

The best time for planting cotton has not been satisfactorily determined for the Philippines, but uniformly good results have been obtained by planting during the latter half of the rainy season. By this method the plant gets its growth during the remainder of the rainy season, and has the dry season with the cool nights and warm days during which to mature.

For planting the land should be laid off in rows from 3 to 4 feet apart. In the wetter soils slight ridges may be thrown up to give the young plants drainage. Much time and money have been spent in constructing machines for planting cotton seed, but perfection has not yet been reached. However, in large cotton-growing sections of the United States these machines are used in preference to the old methods of hand planting. In the Philippines it is usual to plant the seed thickly in the row in order that a good stand may be obtained and that seeds which are not permitted to grow may act as a fertilizer for the young plants. When the plants are well up they are thinned to 15 or 18 inches apart in the row. During the growth of the plants such cultivation is given as will keep down the weeds and grass and keep the soil in good tilth.

The bolls do not all ripen at the same time, thus necessitating several pickings before the crop is harvested. The picking must be done by hand, as no machine has yet been devised which will gather the fiber free from the leaves and bolls.

USES AND YIELD.

The uses of cotton are numerous. Indeed, it is more extensively used than any other fiber. It is most extensively used for cloth, thread, ropes, pillows, and cushions. In Ilocos blankets are made which, though not of the finest finish, are very durable. Most of the cotton of the Philippines, however, is used for weaving into coarse cloth for shirts and pantaloons. The entire cotton plant is useful. Aside from the lint, the seeds are valuable for the oil they contain, and they are very valuable for cattle feed and as a soil fertilizer, being rich in nitrogen. A valuable fiber is produced in the bark of the plant which will be useful when a machine can be made to extract it. The roots contain medicinal properties.

The proportion of cotton grown in the Philippines to that consumed is very small. As none is exported it is difficult to know the exact production, but it is safe to say that not more than 100 tons have ever been produced in a single year. The importations for the twelve months ending June 30, 1900, and for the twelve months ending June 30, 1901, are shown in the following table:

Article.	1900.		1901.	
	Pounds.	Value.	Pounds.	Value.
Raw cotton	412,722	$37,145		$69,240
Cloths		439,398		7,033,825
Yarn and thread	1,615,578	517,506	5,684,839	1,160,583
Total value		993,949		8,263,648

This does not include many of the finer weavings, laces, carpets, and the like.

The Philippines offer many advantages for cotton raising. It may be that in many localities there is not enough sunshine for that part of the rainy season during which the cotton is growing, but the labor conditions, the good soil, and the demand for the fiber and its products are strong arguments for a more extensive industry.

RAMIE.

Two plants, *Boehmeria nivea* and *B. tenacissima,* belonging to the family *Urticaceæ,* produce fibers which, in commerce, are recognized indiscriminately by the names China grass and ramie or rhea. It has been proposed by Doctor Morris, of the Kew Gardens, that the name ramie refers to the fiber of *B. tenacissima* and that of China grass to *B. nivea.* This suggestion has been adopted by recent writers. Neither of these fibers is now produced on a commercial scale in the Philippines, and we have not collected material by which to determine the species grown here. Neither has it been determined which fiber possesses the more qualities and characteristics of usefulness. *Boehmeria nivea,* however, is easily distinguished from *B. tenacissima* in that the lower surface of its leaves is whitish. This species also grows farther north than the *B. tenacissima* and is not so robust in appearance.

These plants are herbaceous, with perennial roots. Under favorable conditions they grow in clusters of 4 to 12 stalks from one root to a height of 3 to 7 feet. They are in all probability natives of Java and Sumatra, though they have been cultivated in China and India for many centuries. This fiber differs from those previously considered in that it occupies a different position in the plant's structure. Ramie is a bast fiber—that is, it is produced between the epidermis of the bark and the woody substance of the stalk, but it serves the same purpose of conducting the sap that the structural fibers serve. When the plants are grown without branching, the fiber is strong and durable. It can be very finely divided, and the ultimate cells are 120 millimeters in length. It is similar to flax in many of its qualities, except, perhaps, it is not so elastic. When degummed it can be combed to almost the fineness and softness of silk. It is not readily affected by moisture, and therefore it is preeminently suited to weaving into cloths. The well-known Canton linen is made from this fiber. Ramie fiber takes dyes readily, and beside the finer cloths and textiles made from it, it is used extensively for cordage nets and lines.

PRODUCTION AND USES.

The greatest quantities of this fiber are produced in China and Japan, where it is extracted by hand. Indeed, the supply is limited to those countries where labor is cheap and abundant, for as yet no machine has been constructed which can produce a fiber as clean and white as that produced by hand. Moreover, the fiber extracted by hand is in a much better state for degumming and combing than that extracted by machinery, because the hand process removes a considerable part of the gum, which is rendered difficult of removal if permitted to dry on the fiber. This gum is not soluble in water, as is that of flax and hemp, so that it must be submitted to chemical treatment, and the conditions under which it must be treated create an expense of about 4.9 cents per pound above the hand-extracted fiber. The fiber may also be extracted by boiling the stalks in water or alkaline solutions, but this has little advantage over the simple hand-cleaning method.

Where the fiber is cleaned by hand, the stalk is grasped about 3 or 4 inches above the ground, and with a skillful jerk the stalk is broken so that it may be stripped from the bark at one motion. The bark is then stripped of its leaves and a second jerk detaches it from the root. By this method the leaves and stalks are left in the field, which are of great advantage to future crops. The ribbons of bark are kept straight and piled up in a shed to ferment slightly. When the epidermis is in a suitable state to peel, the operator takes a few ribbons at a time in the left hand, and with the right hand, the thumb of which is armed with a small metal scraper, the epidermis is stripped off. The fiber is then put out to dry. In China and Japan most of the fiber is exported in this state. That which is retained for local use is submitted to a treatment of alkali in order to remove the gum. This renders the fiber more pliable and it can be more finely separated. In Europe the process of degumming and combing is carried to a high state of perfection, so that a fiber is produced which is suitable for mixing with silk or linen. I do not know that the process of degumming is practiced at all in the Philippines.

The uses to which ramie may be put are quite as general as the uses of cotton, the cost of production alone preventing it from entering into a more extensive consumption. That which is produced in the islands is used for the most part for mixing with abaca, silk, and the pineapple fiber in the manufacture of a great many varieties of fabrics, but the production does not supply the demand. In 1900, 563 pounds, valued at $39, and in 1901, 8,308 pounds, valued at $415, entered the port of Iloilo. This shows a considerable increase in quantity for 1901, but according to the figures the price dropped almost 2 cents per pound.

PLANTING AND CULTIVATION.

Inasmuch as the ramie plant has a perennial root and does not require to be planted every year, it is quite necessary that the land chosen for the plantation be put in good tilth by deep plowing and thoroughly fining the soil. The plants have to be set so thickly in order to prevent branching and to cause the stalks to grow straight that after cultivation is not an easy matter. This deep plowing is quite important also that the soil may drain well, as the plant will not thrive in a wet soil. For climatic conditions, this plant requires a humid atmosphere, with frequent rains or irrigation and a warm temperature, so that the growth may be rapid and luxuriant. Vast areas in the Philippines possess just such characteristics of soil and climate as this plant desires, and every effort should be made to promote its cultivation.

The ramie plant may be propagated by seeds, by cuttings, or by divisions of the roots. The last is the best method when it is convenient, as the seeds are sometimes not produced in abundance, and the seedlings require some care. Propagation by cuttings requires longer to mature a crop. When it is necessary to plant seeds they should be sown in loose loam and lightly covered with fine soil. The seed beds should be shaded with nipa or a bamboo matting to protect the young plants from the direct rays of the sun. When the young plants are from 3 to 5 inches high they may be transplanted in the field.

Cuttings should be taken from the upper half of the stem of the plant when mature and cut from four to six buds. They should be rooted in porous soil, containing a goodly amount of sand, and shaded until the leaves begin to grow. Plants from cuttings or from seed do not produce a crop of good fiber the first year.

The root divisions may be transplanted in the field at once, and if the season be good the plants will produce a small crop of fiber from the first cutting of stalks, but the succeeding crops will be heavier.

In general the plants are placed in rows 18 inches to 2 feet apart and from a foot to 18 inches apart in a row. Thick planting is necessary in order that the plants grow tall and without branches, for upon both of these characteristics does the value of the fiber depend. If the soil is of good depth and contains a sufficient amount of humus the plants should grow to a height of 6 to 8 feet and produce two or three crops a year. On the best lands in the northern provinces of Luzon, about the only district in the Philippines where ramie is produced, four crops can be taken each year.

It is a common practice in some parts to burn over the field after each successive crop. While the ashes are valuable constituents of the soil, yet the humus which would result from incorporating the leaves and stalks in the soil would be of far more lasting benefit. When the crop is removed the land should be cultivated by plowing, if possible, to loosen up the soil, and light cultivation should be continued until the plants become too high to be worked. The application of nitrogenous and potassic fertilizers usually produces good results, and the application of barnyard manures will always result in much advantage to the soil.

It is estimated that an acre of three cuttings per year produces 25 tons of stalks. From careful estimates in France it has been determined that a ton of green stalks will produce 46½ pounds of dry fiber (De Landtsheer). This would give a yield for these islands of about 1,162.5 pounds of dry fiber per acre. This in turn would yield about 625 pounds of degummed fiber.

At the present time the untreated fiber is worth from 5 to 7 cents a pound or from $100 to $140 a ton. At this price and with favorable climatic conditions and cheap labor the production of this fiber ought to become a resourceful industry.

PANGDAN.

(*Pandanus.*)

This genus embraces some thirty species, seventeen of which are reported from these islands. The common name by which these plants are known is "screw pine," a name suggested by the spiral arrangement of the leaves around the stem. Because of this arrangement and the peculiar aerial roots the plants are highly prized for their ornamental effect.

Of the species which grow in the Philippines four are worthy of mention: *Pandanus dubius* Spreng, *P. odoratissimus* L., *P. radicans* Blanco, and *P. montanus* Miq. These species vary but little, except perhaps *P. odoratissimus*, which is more tree-like, being much branched. I have seen this species growing in considerable abundance in the poor, dry soil south of Bacolod, Negros. The leaves of all of them are from 4 to 5 feet long and 1½ to 3 inches wide and spiny along the edges. They bear a fruit which is somewhat similar in appearance and size to a pineapple.

These plants are of economic value because of their thin fibrous leaves. While they are not cultivated anywhere in the islands, yet their leaves are harvested in large quantities for the manufacture of bags and mats. Much of the sugar which is produced in Panay and Negros is put up in bags made from the leaves of these plants, mainly in the provinces of Capiz and Antique. Sleeping mats and mats for the floor and wall are also made from these leaves, and these are of value because when folded they do not break.

In making these articles the leaves are gathered when mature and split into fillets of desired width. These are then woven into whatever shape and pattern desired, and the ends are not tied, but lapped. The material dyes readily, and by the use of fillets of different colors ornamental as well as useful weavings may be made. One plant during the year will produce enough leaves for about two sugar bags or a bed mat.

In India the leaves have been used for paper stock, but no trials for this purpose have thus far been made in the Philippines.

The arial roots of these plants contain a fiber, though it is seldom extracted at the present time. The roots are frequently cut, however, and after removing the pulp from the ends by pounding they are used for paint and whitewash brushes. In some species this root fiber is fine, and it is suggested that it might be used in brush making.

BURRI OR TALIPOT PALM.

(*Corypha umbracullifera.*)

This plant, a member of the *Palmaceæ*, grows in greater or less abundance in all parts of the archipelago. It is said that the Island of Burias takes its name because of the abundance of these plants growing there. Although these palms are nowhere cultivated, yet they are of great utility to the natives. They bear large fan-like leaves, with all the leaflets radiating from the end of the long stem—in themselves very ornamental. These leaflets, sometimes 3 or 4 feet long, are used for practically the same purpose as those of the pangdan, only they produce a coarser grade of matting, baskets, or hats, because the fillets are less pliable and coarser. Hats of good quality are made from the leaves of the burri, and the coarser mats and cushion covers are usually of this material. The fillets may be stripped very finely and they dye readily.

This palm thrives in almost any soil except marshes and grows to a height of 30 to 50 feet. They bear hard, scaly fruits on a raceme, which terminates the stem, and after fruiting die. They are natives of Ceylon and the Malabar coast.

The Filipinos make sugar, sirup, and wine from the sap of the burri, and it also possesses medicinal properties.

NIPA.

(*Nipa fruticans Thumb.*)

It has been said that nipa ranks next to the bamboo as a plant of usefulness to the Filipinos. The plant belongs to the *Palmaceæ* and grows almost exclusively in the marshy lands along the shores and in the deltas of rivers. It does not grow tall, and the leaves are very similar in structure and color to those of the cocoanut.

When the leaves are mature they are cut and the leaflets are stripped from the stem. While these leaflets are still green they are bent in the middle over a small piece of bamboo about two yards long, or shorter if the particular use to which they are to be put demands it, and sewed near this bamboo rib or stay with rattan or fine strips of bamboo, thus forming a small mat with the ends of the leaflets loose. These are laid on the roofs and sides of houses in the manner of placing shingles upon a roof. Almost everywhere in the Philippines, when durability and cheapness are considered, perhaps no better substitute can be found. In situations where the wind is not strong for a large portion of the year this material will last five or six years on a roof of one-half pitch. On roofs of slighter pitch the period of duration is less. Usually for siding the small mats are battened down with small strips of bamboo. In this way they will last for many years.

An acre of marsh land well planted will yield about 50,000 of the small mats per year.

The young leaves of the nipa are used for making hats, mats, sails, and rain coats. The leaflets are stripped into fillets and braided or woven in the same way that pangdan and burri are worked.

Juice taken from the flower stem produces a wine or alcohol called tuba, highly esteemed by the natives, and the fruit is edible.

RATTAN.

(*Calamus.*)

Species of rattan are found in great abundance throughout the mountainous and forest regions of the Philippines. They are climbing palms, growing sometimes to a height or length of 300 feet. Almost no investigations have been made upon these plants in the Philippines, but specimens of both the "cane" and body rank well with those obtained in Ceylon and the Malay peninsula.

Rattan has not yet reached the importance of an article of export for the Philippines, but no doubt, as the better species become known and means for obtaining them are improved, they will take their place as one of the articles of export. To the Filipinos they are almost all very useful. Both the cane and the body are extensively used in the manufacture of furniture, baskets, and mats. The vine entire is used for ropes, draw lines for ferry rafts, walking sticks, and for numerous other purposes. The cane used for seating chairs, beds, and the like is the outside hard and resistant portion stripped off. These strips are inelastic, though very pliable, but care must be taken in bending or tying them that the smooth outside be on the convex, otherwise they will break easily. Because of their inelasticity they are very useful for lashings, especially in the construction of houses. In Negros and Panay they are extensively used for binding bags of sugar, cacao, and copra.

Rattan will probably always remain a product of the forest, for, from the nature of the plant's growth, tall trees are required for it to run upon. Advantage will result, however, from training them upon the trees, so that they will not become cramped and crooked.

The most useful species at the present time found in the Philippines is *Daemonorops melanochaetes* Blume. While this does not produce the finest canes, yet they serve the greatest number of purposes, and the plant entire is most commonly used for draw lines for ferry rafts. The flowers produce a nectar from which the bees render a superior grade of honey.

CONCLUSION.

In the rich vegetation of the Philippines many fiber-producing plants occur, the fiber of which is of local use and importance, but whose properties have not been brought to the notice of buyers and consumers. In determining the value of a fiber for economic and commercial purposes the question need not be carried further than the determination whether the new fiber can be used as a substitute for any of the well-known commercial fibers or whether some new economic use can be established for it. If these considerations are established, then the demand will in time regulate the questions of production and extraction. The world's present demand for fibers is supplied from only about forty species of plants, and while some of these are less valuable from the standpoint of strength and durability than some less commonly known ones, yet their use has become established and machines and methods have been adapted to their manufacture. Against these, new fibers must compete, though superior utility may be in their favor.

Among the little-known fibers of the Philippines which are of high quality and promising value may be mentioned the Eruc from *Corypha urens*, which is a strong fiber, nonresistant in water, the bow-string hemp, similar to sisal, and fibers from the species of Hibiscus. Investigations of these and other economic species are now under way, and it is expected that their value and utility may be more fully established.

Partial list of fibrous plants of the Philippine Islands.

Scientific name.	Native name.	Where found.	Uses, etc.
Abroma alata L	Ambong		
Abroma augusta L	Nabo	Occidental Negros	For cords and ropes.
Agave americana L	Maguey	Ilocos, Union, and Abra.	For ropes, cords, and to a small extent for fabrics.
Ananas sativa Schult	Piña	Southern Luzon and Panay.	For thread and fabrics.
	Imagdong	Occidental Negros	For ropes and cords.
Artocarpus incisa L	Antipolo	do	Do.
	Banuacalao	Tarlac	Do.
	Baroy	do	Do.
	Barinas	do	Do.
Bauhinia cumingiana F. Vill	Banos	Tayabas	Do.
Bauhinia scandes L	do	do	Do.
Boehmeria nivea Hook	Amiray	Ilocos	For cords, threads, and fabrics.
Bombax ceiba Linn	Maracapas	Tarlac	For ropes and stuffing.
	Bulobulo	Bulacan	For cordage, etc.
Calamus sp	Locoan	Masbate	For bindings and lashings.
Calamus sp	Lambotan	Tayabas	Do.
Calamus albus Pers	Palasan	Masbate	Do.
Calamus buroënsis Mart	Talola	Tayabas	Do.
Calamus concinnus Mart	Ouay-na-pula	Zambales	Do.
Calamus discolor Mart	Balinanay	Bataan	Do.
Calamus equestris Willd	Quay	do	Do.
Calamus haenkaenus Mart	Ditaan	Zambales	Do.
Calamus javensis Blume	Apis	do	Do.
Calamus pisacarpus Blume	Yatoc limoran	Bataan	Do.
Calamus rhomboideus Blume	Ditaan	Zambales	Do.
Calamus scipionum Lour	Buton	Masbate	Do.
Caryota urens L	Idyocerne	Tayabas, Negros	For ropes and thatch.
Cocus nucifera L		All coasts	For brushes, ropes, and coarse weavings.
Columbia analao Blanco	Analao	Union	For cordage.
Corchorus acutangulus Lam	Saluyot	Camarines Sur	Do.
Corchorus capsularis L	Pasao-na-bilog		Do.
Corchorus olitorius L	Pasao	Batangas	Do.
Cordia myxa Linn	Ananong	do	Do.
Corypha umbraculifera L	Silac, Burri	Union, Negros	For mats, hats, and bags.
Daemonorops melanochaetes Blume.	Parasan	Leyte, Samar	For bindings and lashings.
Gnetum scandens Roxb	Colias	Tarlac	For cordage.
Gossypium herbaceum L	Bulac	Ilocos	Do.
Grewia laevigata Vahl	Dauglin	Batangas	Do.
Grewia multiflora Juss	do	do	Do.
Hibiscus abelmoschus L	Castuli	Bulacan	Do.
Hibiscus tiliaceus L	Balibago	Tayabas, Masbate	For mattings, ropes, and paper.
Hibiscus tiliaceus L	Impid	Camarines	For cordage.
Kleinhovia hospita L	Tanag	Bulacan	Do.
Lygodium scandens Sw	Nito	Camarines	For hats, mats, and ropes.
	Malasap sap	Bulacan	For cordage.
Melochia arborea Blanco	Balicnong		Do.
	Maratarong	Tarlac	Do.
Musa paradisiaca L	Saging	All provinces	Do.
Musa textilis L	Abaca	Camarines, Albay, Mindoro, Cebu, and others.	For ropes, cords, and fabrics, largely exported.
Napea scabra Blanco	Anabo		
Nipa fruticans Thumb	Ogpoy	Zambales	For ropes, hats, and mats.
	Nipa	All coasts	For mats and thatch.
Pandanus dubius Spreng	Bariu	Leyte, Samar, Negros, Northern Luzon, Mindanao.	For mats, hats, bags, baskets, sails, and the like.
Pandanus odoratisimus L	Pangdan		
Pandanus radicans Blanco	Olango		
Pandanus montanus Miq	Mingo		
Phaleria sp	Salagos	Camarines	For cordage.
Pterospermum diversifolium Blume.	Bayog		
	Queddeng	Tarlac	Do.
Sida fructescens Cav	Escobang naba		
Wilkstroemia ovata C. A. Mey	Salago	Nueva Ecija	Do.
Zanthoxylum avicennae DC	Casay		

BUREAU OF AGRICULTURE.

(Bulletin No. 5.)

LIST OF PHILIPPINE AGRICULTURAL PRODUCTS AND FIBER PLANTS.

By Prof. F. Lamson-Scribner, Chief, Bureau of Agriculture, 1904.

INTRODUCTION.

There are a great many economic plants in the Philippines, some of much importance, forming articles of commerce between one island and another or between the islands and other countries of the world; others of less importance, but often playing a significant part in the domestic economy of a few favored localities, while others still are utilized by wild tribes or under special circumstances. Like all races wholly or largely dependent upon their own resources for food and raiment, the people have acquired a close familiarity with the plants about them and have discovered uses for a multitude of native products which would have remained unknown to a more highly civilized and less dependent race. Several economic species now widely distributed throughout the archipelago were introduced from America many years ago by the Spaniards. A great deal of good has been accomplished and the resources of the Filipinos materially increased as a result of this early work. These plants have been included in the list here presented, and a few have been included that are not strictly fruits or vegetables. They are products, however, which are common in the markets of Manila, having been grown or gathered by the small farmer, who derives a little income from their sale.

The information contained in this list is based very largely upon the reports of the correspondents of the bureau of agriculture, who have very generally and very fully replied to all our inquiries. These reports contain many names of economic plants which belong to this list, but which have been omitted, as they still remain unclassified. Efforts are now being made to identify these yet undetermined species and to verify the classification of those here submitted where there remains any doubt as to their proper identification. It is believed that the publication of this list will help to incite an interest in Philippine agricultural products and assist in securing a wider and better knowledge of the wonderful resources of the islands.

FRUITS AND VEGETABLES.

This list is alphabetically arranged according to the native or local names. The several local or native names applied to any one plant appear together under the Latin name, the name under which the description occurs being in small caps.

ACELGA (Beet). *Beta vulgaris*, Linn.

A vegetable found nearly throughout the Archipelago, especially in Benguet; grown for local consumption. The leaves are used as a condiment, etc., and the fleshy roots are edible when cooked.

ACHIOTE. *Bixa orellana*, Linn.

A small tree, 20 to 30 feet in height, found throughout the Archipelago, although not largely grown; introduced from tropical America. The fruit yields a coloring matter and is used in cookery, to color butter, cheese, etc. The annatto of commerce.

ACHOTE. See *Achiote.*

ACHRAS SAPOTA, Linn. Chico, Sapodilla, Sp. T.; Chicle, Eng.

ACHUETE. See *Achiote.*

ADAM'S NEEDLE. See *Camoteng cahoy.*

ADYANGAO. *Albizzia procera*, Benth.

A tree, furnishing a resin used as incense.

AGARIC. See *Payong ahas.*

AGARICO. See *Payong ahas.*

AGARICUS SP. *Payong ahas*, T.; Agarico, Sp.; Agaric or Mushroom, Eng.

AGATHIS LORANTHIFOLIA, Salisb.

A lofty tree, from which the valuable resin called "almáciga" (dammar of commerce) is extracted. It is found on the mountains of souththern Luzon and Panay Islands at elevations of from 500 to 1,000 meters. The resin is sold in Manila at $7 to $8, Mexican, per picul. The best comes from the Camarines.

AGAYAC. *Phaseolus* Sp.

A bean grown in Cagayan Province in small quantities for local use.

AGAYAP. See *Agayac.*

AGUISIP. *Melastoma polyanthum*, Blume.

A tree, the bark of which yields a bright red coloring matter. This is used to dye hemp cloths.

AJO. See *Bawang.*

AJONJOLÍ. See *Lingá.*

ALAÑGILANG. See *Ilang-ilang.*

ALANIHAO. *Dracontomelun* Sp.

A native tree, 90 feet or more in height, found in Romblón and other islands. The fruit is edible.

ALBIZZIA PROCERA, Benth. ADYANGAO.

ALBIZZIA SAPONARIA, Blume. COGONTOCO.

ALCAPARRAS (Caper). *Capparis mariana*, DC.

A shrub, 7 feet high; the buds and fruits are used as a condiment; found in Rizal Province, very scarce.

ALEURITES SAPONARIA, Blanco. BAGUILUMBAN, T.; Balocanad, V.; Balucanang, Il.; Calumban.

ALEURITES TRIOBA, Forst. Capili, LUMBANG, T.

ALIBANBAN (St. Thomas's Tree). *Bauhinia tomentosa*, Linn.

A small tree, 20 feet high, growing wild in Rizal and other provinces. The leaves yield an acid used as a substitute for vinegar.

ALIPAI. *Euphoria litchi*, DC.

A tree native of Luzon and other islands, yielding an edible fruit.

ALLIUM CEPA, Linn. Lasona; SIBUYAS, T.; Cebolla, Sp.; Onion, Eng.

ALLIUM SATIVUM, Linn. BAWANG, T.; Ajo, Sp.; Garlic, Eng.

ALLIUM TRICOCCUM, Ait. CUCHAY, Cutsay, T.; Ganda, V.; Wild leek, Eng.

ALMÁCIGA (Pitch, Dammar of commerce). Valuable native resin extracted from trees belonging to the genera *Agathis*, *Canarium*, etc. Produced in large quantities in Mindanao Island for export, and quoted in Manila from $7 to $8, Mexican, per picul. The best is from Calamianes Islands.

ALMOND. See *Dalisay.*

ALOPAI. See *Alipai.*

ALPASOTES. *Chenopodium ambrosioides*, Linn.

A native herb found throughout the Archipelago. The leaves are used for seasoning food.

ALPAI. See *Alipai.*

ALPISTE (Canary grass or canary seed). *Phalaris canariensis*, Linn.

A grass grown rather for ornament in Abra, Ilocos Norte, and Ilocos Sur. The grain is used for feeding canary birds.

ALUPAY. See *Alipai.*

ALUPE. See *Alipai.*

AMAGA. See *Boloñgaeta.*

AMARANTHUS SPINOSUS, Linn. Bayang-bayang, Il.; Calites, V.; COLETES, T.; Colitis, T.; Cuanton; Harum, V.; Orayi.

AMARGOSO. See *Ampalayá.*

AMERI. See *Tayom.*

AMPALAYÁ (Balsam apple). *Momordica balsamina*, Linn.

An annual climbing plant 4 to 6 feet high; flowers yellow; grown for local consumption in Luzon and other islands. The fruit and leaves are used as condiment, for salad, etc. Two well-marked varieties are grown; both have a distinctive bitter taste.

AMPALEA. See *Ampalayá.*

ANACARDIUM OCCIDENTALE, Linn. Baludad, T.; Balubat, Pn.; Balurad, T.; Bologo, Il.; CASOY, T.; Cashew, Eng.

ANANAS SATIVUS, Schult. PIÑA, T., Sp.; Pineapple, Eng.

ANANGCA. See *Langkâ.*

ANATTO. See *Achiote.*

AÑGILANG. See *Ilang-ilang.*

ANIS CAHOY (Nutmeg). *Myristica philippinensis*, Lam.

A tree found growing naturally in Cavite and Laguna Provinces, and the Island of Cebú. The fruit or nut is used as a condiment.

ANIS ESTRELLADO (Fennel). *Fœniculum vulgare*, Gaertn.

A perennial plant, grown in very small quantities throughout the Archipelago. The seeds are used for dressing, sweetmeats, etc.

ANISOPTERA THURIFERA, Blanco. LAUAN or LAUA-AN, V.

ANISOPTERA OBLONGA, Dyer. SANDANA.

ANNOTTA. See *Achiote*.

ANONA MURICATA, Linn. Gayubano, Il.; Guanabano, P., Il.; Guayabano, T.; GUYABANO, T., V.; Guanabena, Eng.

ANONA RETICULATA, Linn. ANONAS, Sp., T.

ANONA SQUAMOSA, Linn. ATES, T., Sp.; Atis, V.; Natis (?), P.; Sugar apple, Sweet-sop, Eng.

ANONAS (Custard apple). *Anona reticulata*, Linn.

An exotic tree, 10 to 20 feet or more high, from Mexico; grown for local consumption on Luzon. The fruit is 3 to 4 inches in diameter and considered excellent eating.

ANSIMAN (Purslane, pusley). *Portulaca oleracea*, Linn. See *Colasiman.*

ANTENG. See *Malapilê.*

ANTIDESMA BUNIUS, Spreng. BIGNAY, P.; Bugnay, T.

ANTIPOLO (Bread fruit). *Artocarpus incisa*, Linn. f.

A tree growing to a height of 40 to 60 feet, found throughout the Archipelago. It is sometimes planted. The sap, bark, and fruit are utilized. The fruit is valued for preserves, and is eaten when cooked.

AÑIL (Indigo, Eng.). See *Tayom.*

APALE or APARA (?). See *Ampalayá.*

APALIA (Balsam apple). See *Ampalayá.*

APASOTIS. See *Alpasotes.*

APIO (Celery). See *Quinsay.*

APITONG. *Dipterocarpus grandiflorus*, Blanco.

A tall tree which yields excellent resin sold in Manila market and exported; used for varnishing. Found in Luzon, Visayan, and Mindanao Islands.

APIUM GRAVEOLENS, Linn. Quinchay, QUINSAY, T.; Apio, Sp.; Celery, Eng.

APIUM PETROSELINUM, Linn. PEREJIL, Sp.; Parsley, Eng.

ARACHIS HYPOGAEA, Linn. MANÎ, T.; Cacahuete, Sp.; Groundnut, Peanut, Eng.

ARECA CATECHU, Linn. Boñga, BUÑGA, T.; Bonga, Sp.; Betelnut, Eng.

ARARAÓ (Bermuda arrow-root). *Maranta arundinacea*, Linn.

An herb sometimes grown for local use in Luzon and other islands. The starchy roots are used for making arrow-root and sago.

ARARÓ. See *Araraó.*

ARNOTTO. See *Achiote.*

ARONGAY (?) (Horseradish tree). See *Malungay.*

ARROZ (Rice). See *Palay.*

ARTOCARPUS CAMANSI, Blanco. CAMANCE, Camansi, V.; Camongsi, Dalangian, Dolongian, Pacac, Il.; Breadfruit, Eng.

ARTOCARPUS INCISA, Linn. f. ANTIPOLO, T.; Rima, Sp., T.; Tipolo, P., V.; Tipoo, V.; Breadfruit, Eng.

ARTOCARPUS INTEGRIFOLIA, Linn. f. Anangca, Il.; LANGKÂ, Nangkâ, T.; Jakfruit, Eng.

ARTOCARPUS RIMA, Blanco. Colo, V.; Ogob, B.; RIMA, T.; Breadfruit, Eng.

ARUNGAY (?). See *Malungay.*

ASPARAGUS. See *Espárrago.*

ASPARAGUS OFFICINALIS, Linn. ESPÁRRAGO, Sp.; Asparagus, Eng.

ASPLENIUM ESCULENTUM, Presl. PACÓ, T.

ATAY-ATAY. *Justicia corrosiva*, Linn.

An ornamental shrub planted in gardens; the leaves are used medicinally.

ATES (Sweet-sop, sugar apple). *Anona squamosa*, Linn.

A small tree or shrub, native of tropical America. It is highly prized for its edible fruit, used for local consumption. In season from June till November.

ATIMON (Melon). *Cucumis melo*, Linn. Var.

An herbaceous vine of Luzon and the Visayan Islands. The fruit is used for dessert, and is grown for local use.

ATIS (Sugar apple). See *Ates.*

AVERRHOA BILIMBI, Linn. Camias, T.; KAMIAS, B., T.

AVERRHOA CARAMBOLA, Linn. BALIMBING, Balinbin, Bilimbin, T.; Carambola, Coromandel gooseberry, Eng.

AZABACHE (Bean). *Phaseolus lunatus*, Linn.

A vegetable growing in Batangas and other places, though it is rarely cultivated. The fruit is used for food.

AZAFRAN. See *Dilao.*

BAGSANG. *Metroxylon rumphii,* Mart.

A very common palm in the Visayan Islands; grows spontaneously in moist regions. The heart of the tree is reduced to a sort of flour which is made into cakes or fritters and eaten with cocoanut milk. A wholesome and nutritious food.

BAGUILUMBAN. *Aleurites saponaria,* Blanco.

A native tree of Luzon and the Visayan Islands. The fruit is used in the manufacturing of an ordinary kind of soap sold in Manila.

BAKAO. *Rhizophora mucronata,* Lam.

A small tree growing in mangrove swamps throughout the Islands. The bark, fruit, etc., are utilized for dyeing and tanning purposes. The wood is much used as firewood.

BAKAWAN. See *Bakao.*

BALANTE. *Homalanthus populifolius,* R. Grah.

A tree whose bark, when dried and reduced to a powder, yields black coloring matter used by the natives for dyeing.

BALAO. *Dipterocarpus vernicifluus,* Blanco.

A tree growing wild in parts of Luzon, Mindanao, and the Visayan Islands, yielding a resin used for varnishing, calking ships, and illuminating.

BALATONG. *Phaseolus mungo,* Linn.

An herb, 3 feet high, grown on a commercial scale throughout the Archipelago. The seed constitutes a staple article of food. Sold by weight or by the cavan. Average market price 5 to 6 cents, gold, per pound.

BALIACAG (Yam, Chinese potato). See *Cobag.*

BALIMBING (Carambola). *Averrhoa carambola,* Linn.

A tree about 25 feet high, cultivated in gardens of Luzon and other islands. The fruit is eaten raw, used for desserts, etc.

BALINBIN. See *Balimbing.*

BALOCANAD. See *Baguilumban.*

BALONGAY. See *Malungay.*

BALSAM APPLE. See *Ampalayá.*

BALSAMINA. See *Ampalayá.*

BALSAMINA. *Momordica cylindrica,* Linn.

A trailing herb, cultivated as a garden vegetable around the city of Manila. The fruit and leaves are edible.

BALUBAD (Cashew). See *Casoy.*

BALUBAT. See *Casoy.*

BALUCANANG. See *Baguilumban.*

BALUNGAY (Horseradish tree). See *Malungay.*

BALURAD. See *Casoy.*

BANANAS. *Musa paradisiaca,* Linn. Var.

Bananas are grown to a great extent throughout the Archipelago. About 57 varieties are recognized. The fruit and leaves are utilized, as is also the flower bud.

BANCURO. *Morinda tinctoria,* Roxb.

A tree the root of which produces a red coloring material, used for dyeing purposes.

BAÑGÂ. See *Pugahan.*

BANGQUILING (Otaheite gooseberry). See *Ibâ.*

BARET. See *Zacate.*

BARIT. See *Zacate.*

BASENG (Ginger). See *Luya.*

BATAD (Sorghum). *Sorghum saccharatum,* Moench.

A grass found in Iloilo, Masbate, Abra, etc., though rarely cultivated. The stem yields sugar, and the roots and seeds are also utilized. Alcohol can be obtained from the sap of this plant.

BATAG (?). See *Batad.*

BATAO. *Lablab cultratus,* DC.

A vine raised in small quantity in Albay, Bulacan, Negros Occidental, Nueva Ecija, Rizal, Tarlac, and Zambales. The fruit is used as vegetable.

BATATA (Irish potato). *Solanum tuberosum,* Linn.

A vegetable of American origin, found in Luzon and other islands. Raised to a considerable extent in Benguet. The tuberous root is used as an article of food.

BATAVIA. *Musa paradisiaca maxima,* Blanco.

A variety of banana, found in Luzon and other islands, and valued for its fruit.

BAUHINIA TOMENTOSA, Linn. ALIBANBAN, T.

BAWANG (Garlic). *Allium sativum*, Linn.

An herb raised in small quantity throughout the Archipelago. The leaves and bulb are used as a food and a condiment. Bulb white.

BAYABAS (Lemon guava). *Psidium guayava*, Linn. Var.

A tree or shrub 10 to 20 feet high, introduced from America, now found throughout the Philippine Islands. The fruit is valued for making jellies and preserves, and is used both locally and commercially.

BAYANG-BAYANG. See *Coletes.*

BEET. See *Acelga.*

BENESEED. See *Liñgá.*

BERENGENA. See *Talong.*

BETA VULGARIS, Linn. Acelga, Sp.; Beet, Eng.

BETELNUT. See *Buñga.*

BETEL. See *Ikmo.*

BICACAO (Millet). *Setaria italica*, Beauv.

A grass found in Luzon, Cebú, etc., though rarely cultivated. The seed constitutes an article of food.

BIGNAY. *Antidesma bunias*, Spreng.

A tree growing wild in Pampanga, Rizal, and other provinces. The fruit is edible, and is good for preserves.

BILANG-BILANG. See *Dampalit.*

BILIMBIN. See *Balimbing.*

BISCO. See *Sabá.*

BITANHOL. *Calophyllum inophyllum*, DC.

A tree growing wild upon the seashores throughout the Archipelago. The seeds are used in making oil, and the bark yields a resin, both highly appreciated by the natives.

BITAOG. See *Bitanhol.*

BIXA ORELLANA, Linn. Achiote, T.; Achote, Achuete, Sp.; Anatto, Annotta, Arnotto, Eng.

BLACK PEPPER. See *Pamintá.*

BOBOA. See *Lanzones.*

BOLOGO. See *Casoy.*

BOLOÑGAETA (Persimmon). *Diospyros pilosanthera*, Blanco.

A native tree producing edible fruit; Luzon and the Visayan Islands.

BOÑGA. See *Buñga.*

BONGA. See *Buñga.*

BOOCAN. See *Lanzones.*

BRASSICA OLERACEA, Linn. *Var.* Repollo, Sp., T.; Cabbage, Eng.

BRASSICA OLERACEA, Linn. *Var.* Coliflor, Sp.; Cauliflower, Eng.

BREADFRUIT. See *Artocarpus.*

BUCACAO (Millet). See *Bicacao.*

BUGNAY. See *Bignay.*

BULAHAN. See *Lanzones.*

BULAY. See *Batao.*

BUÑGA (Betelnut). *Areca catechu*, Linn.

A palm raised in all gardens throughout the Archipelago; it grows to a height of about 30 feet. The nut is chewed by the natives. The leaves, stalk, and seeds are also utilized. The nuts are valued at about 5 cents, gold, per hundred.

BUÑGULAN. *Musa paradisiaca suaveolens*, Blanco.

One of the best and most highly flavored varieties of banana, widely grown for its fruit.

BURI. *Corypha umbraculifera*, Linn.

A lofty and beautiful palm, very well known in the Philippines for its usefulness, giving name to the Island of Burias, where it is found abundantly. Sago of commerce is obtained from the soft interior part of the trunk. The fruit is edible, and tuba is obtained from an incision in the same. The tuba is made into wine and also a sort of sugar called *pacascás*, resembling maple sugar.

BUTINGA (Kidney bean). *Phaseolus vulgaris*, DC.

A common vegetable grown for local consumption only, in Batangas, Pampanga, etc.

BUYO. See *Ikmo.*

CABATETE. *Rhamnus*, Sp.

A shrub, 9 to 12 feet high, found in Nueva Vizcaya. The leaves are edible.

CABATITI. See *Cabatete.*

CABBAGE. See *Repollo.*

CABIQUI. *Mimusops elengi*, Linn.
A native tree, about 40 feet high, with fragrant flowers and edible fruit, found on Luzon and other islands. It is sometimes planted in gardens.

CABITCABAG. *Mezoneurum glabrum*, Desf.
A native vine of Luzon and the Visayan Islands. The tender stems are cooked and used for making salad; the leaves are used medicinally.

CABUYAO. *Citrus torosa*, Blanco.
A variety of lemon grown in Luzon for local use. The rugose fruit is utilized in bathing and for bleaching, and is edible, though not ordinarily used as an article of food.

CACAHUETE. See *Manî*.

CACAO (Cocoa, chocolate bean). *Theobroma cacao*, Linn.
A shrub or small tree of great importance, found throughout the Archipelago, introduced from America in the sixteenth century. It is grown to a large extent. The seeds are used for making chocolate. Large quantities of cacao of excellent quality are produced in Southern Mindanao and District of Davao. The native product commands a better price than that imported from Singapore.

CADIOS. See *Caguios*.

CADIWS. See *Caguios*.

CAESALPINIA SAPPAN, Linn. Sapang, Sibucao or Palo campeche, T.; Palo-Brasil, Sp.

CAFÉ (Coffee). *Coffea arabica*, Linn.
A bush 8 feet high, more or less, found throughout the Philippine Islands. It is valued for the seed (berry), which is a staple product, the best quality being grown in Batangas.

CAGEL (Large lemon). *Citrus aurantium*, DC.
A lemon tree, growing on Luzon and other islands, whose fruit is highly esteemed, being one of the best varieties, valued at from 20 cents to $1 per hundred. This tree furnishes a resin used for illuminating purposes.

CAGUINDI. See *Calit-calit*.

CAGUIOS. *Cajanus indicus*, Spreng.
A vegetable found in Occidental Negros, Romblón, Antique, etc., though rarely planted.

CAHAWA. See *Café*.

CAHIL. See *Cagel*.

CAJANUS INDICUS, Spreng. Cadios, Cadiws, V.; Caguios, T.

CALABASANG PULÁ (Red squash). *Cucurbita maxima*, Duchesne.
Red squash is found throughout the Archipelago in several varieties which are grown for local use. The flowers and fruit are used for condiment, sweetmeat, etc.

CALABASANG PUTÎ (White squash). See *Upo*.

CALADI. *Colocasia esculenta*, Schott. Var.
A perennial herb raised in small quantity on Panay Island. The leaves, young shoots, and starchy roots are edible.

CALAMANSÎ (Small lemon). *Citrus mitis*, Blanco.
A small tree 10 to 15 feet high, found in nearly all gardens. The fruit, which is produced in great abundance, and leaves are utilized for condiments, and also in bathing, as a perfume. The fruit is also used as a substitute for limes. In the market at all seasons. Price 10 to 20 cents per hundred.

CALAMISMIS. *Psophocarpus tetragonolobus*, DC.
An herbaceous vine, grown as a garden vegetable. It is found in Luzon and Panay Islands, and grows wild in some places. The young pods are used for a condiment, salad, etc.

CALAMUNDING (Small lemon). See *Calamansî*.

CALAVAGA (Cucumber). See *Pepino*.

CALIT-CALIT. *Cissus acida*, Linn.
A low climbing herb, spontaneous in the Visayan and Luzon Islands. The young fleshy stems and leaves are edible and are used as a substitute for vinegar.

CALITES. See *Coletes*.

CALOPHYLLUM INOPHYLLUM, DC. Bitanhol, Bitaog, T.; Dancalan, Dincalin, Tamauian; Palo María, Sp.

CALUMBAN. See *Baguilumban*.

CALUT. See *Namî*.

CAMACHILÉ. *Pithecolobium dulce*, Benth.
A tree, 25 to 40 feet in height, found on Luzon Island, having been introduced from America. It grows spontaneously and the fruit is edible. The bark is used for tanning purposes and charcoal made from the wood is used in manufacturing gunpowder.

CAMALONGAY. See *Malungay.*

CAMALUGAY. See *Malungay.*

CAMALUSON. See *Calamismis.*

CAMANCE (Breadfruit). *Artocarpus camansi*, Blanco.

A tree, 60 feet or more in height, growing in Luzon, Antique, Iloilo, and other islands, though rarely cultivated. The seeds may be eaten raw or cooked. The flowers are used for sweetmeats.

CAMANCHILE. See *Camachilé.*

CAMANGEG (?). See *Sitao.*

CAMANGIAN. See *Sitao.*

CAMANSI. See *Camance.*

CAMANSILE. See *Camachilé.*

CAMÁS. See *Sincamás.*

CAMATIS (Tomato). *Lycopersicum esculentum*, Mill.

An herbaceous plant from America. Several varieties are raised throughout the Archipelago. The fruit is utilized for dressing, sweetmeats, etc., and eaten raw or cooked. Usually marketed in Manila in two-bushel baskets, the price per basket varying from 20 cents to $2, gold, according to the season.

CAMIAS. See *Kamias.*

CAMONGSI. See *Camance.*

CAMOTE (Sweet potato). *Ipomea batatas*, Poir.

A trailing vine, many varieties of which are cultivated throughout the Archipelago, and constitute a staple product. The tuberous root and the leaves and shoots are the parts used. White and red varieties are found in Manila markets. Usually sold by number, price varying according to the size of the potatoes.

CAMOTI. See *Camote.*

CAMOTENG CAHOY (Cassava). *Manihot utilissima*, Pohl.

A shrub, about 10 feet high, of American origin. The well-known tapioca is extracted from the starchy fecula of its roots. It is found both wild and cultivated in some provinces. The natives make a good sweetmeat of the roots, which finds a ready sale among them.

CANANGA ODORATA, H. F. et T. Alañgilang, T.; Añgilang, V.; Ilang-ilang, Ylang-ylang, T., Sp.

CANARIUM ALBUM, Blanco. Pilani, T.; PILÎ, V.

CANARIUM GRACILE, Eng. Malapile; Anteng, Il.

CANARY GRASS. See *Alpiste.*

CANCONG. *Convolvulus repens*, Willd.

An aquatic vine, growing wild throughout the Archipelago. The stem is used in making salad, etc.

CANDONG. See *Colis.*

CANELA (Cinnamon). *Cinnamomum burmanni*, Blume.

A small tree or shrub whose bark is used as a spice. It is found in the Philippines, especially in Mindanao; and formerly was cultivated.

CANABONG. See *Panarien.*

CAONG. *Caryota onusta*, Blanco.

A sort of sago is extracted from the fibrous stalk of this palm; and also tuba from an incision in the fruit.

CAPAYAS. See *Papaya.*

CAPER. See *Alcaparras.*

CAPILI. See *Lumbang.*

CAPPARIS MARIANA, D. C. ALCAPARRAS, Sp.; Capers, Eng.

CAPSICUM Sp. CHILE, Sile, T.; Pimiento, Sp.; Red pepper, Eng.

CAPSICUM MINIMUM, Roxb. CHILENG BUNDOC, T.; Pasitis; Guindilla, Sp.; Red pepper, Eng.

CARAMBOLA. See *Balimbing.*

CARAMPALIT. See *Dampalit.*

CARICA PAPAYA, Linn. Capayas, V.; PAPAYA, Sp., T.; Papaw, Eng.

CAROT. See *Namî.*

CARROT. See *Zanahoria.*

CARYOTA ONUSTA, Blanco. CAONG, Cauong, Iroc, T.

CARYOTA URENS, Linn. Bañgâ or PUGAHAN, T.

CASHEW. See *Casoy.*

CASLA (Physic nut). See *Tuba.*

CASOY (Cashew). *Anacardium occidentale*, Linn.

A tall shrub, or finally a tree 30 to 40 feet high, grown sparingly on Luzon and other islands, having been introduced from tropical America. Fruit and seeds are edible, the former for dessert and the latter to mix with chocolate after being roasted. Oil is obtained from the seeds. Of much economic value.

CASSAVA. See *Camoteng cahoy*.

CASTANOPSIS Sp. TALACATAC (Wild chestnut).

CASTANOPSIS PHILIPPINENSIS, Vidal. TACATAC (Wild chestnut).

CASTOR OIL. See *Tañgantañgan*.

CATIMON (Melon). See *Atimon*.

CATMON. *Dillenia philippinensis*, Rolfe.

A tree, the acid fruit of which is used by the natives as substitute for vinegar.

CATODAY. See *Katuday*.

CATUDAY. See *Katuday*.

CATURAY. See *Katuday*.

CAULIFLOWER. See *Coliflor*.

CAUONG. See *Caong*.

CAVILAN. See *Calit-calit*.

CEBOLLA. See *Sibuyas*.

CELERY. See *Quinsay*.

CHAMPACA. *Michelia champaca*, Linn.

A tree, 15 feet high, cultivated in gardens. A fine essence is extracted from its flowers.

CHENOPODIUM AMBROSIOIDES, Linn. ALPASOTES, Apasotis, T.

CHÍCHARO (Peas). *Pisum sativum*, Linn.

A tendril-climbing herb, grown as a garden vegetable in Batangas, Bulacan, etc.

CHICLE. See *Chico*.

CHICO. *Achras sapota*, Linn.

A tree, 20 to 30 feet high, introduced from America and cultivated in gardens throughout the Archipelago. The fruit is edible and the sap yields valuable gum. It is highly appreciated.

CHICO MAMEY. See *Mamey*.

CHILE (Red peppers). *Capsicum* sp.

An herb or shrub, many varieties of which are cultivated as garden vegetables throughout the Archipelago. The leaves and fruit are used in cookery.

CHILENG BUNDOC (Red pepper). *Capsicum minimum*, Roxb.

A shrub found upon Luzon Island. It is sometimes planted and the fruit is used in cookery, etc.

CHILE PICANTE. See *Chile*.

CHINESE POTATO. See *Cobag*.

CICHORIUM ENDIVIA, Linn. ESCAROLA, T., Sp.; Endibia, Sp.; Endive, Eng.

CILANTRO. *Coriandrum sativum*, Linn.

An herb, raised in small quantity as a garden vegetable on Luzon and other islands, whose leaves, stem, and seed are used for dressing.

CINNAMOMUM sp. CANELA, T., Sp.; Cinnamon, Eng.

CINNAMON. See *Canela*.

CINNAMON VINE. See *Cobag*.

CIRUELAS. See *Siruelas*.

CISSUS ACIDA, Linn. Caguindi, V.; CALIT-CALIT, Cavilan, T.; Culutpamu, P.; Lañgiñgî, Lopó, Lopó-Lopó (?), Lupo, Pacopol, V.

CITRULLUS VULGARIS, Schard. PAKWAN, T.; Sandía, Sp.; Watermelon, Eng.

CITRUS AURANTIUM, DC. CAGEL, Cahil, T.; Large lemon, Eng.

CITRUS DECUMANA, Linn. LUCBAN, Suhâ, T.; Naranja, Sp.; Orange, Eng.

CITRUS MEDICA, Linn. LIMÓN REAL, Sp.; Lemon, Eng.

CITRUS MEDICA, Linn. Var. acida. DALAYAP, T.; Limón, Sp.; Lemon, Eng.

CITRUS MITIS, Blanco. CALAMANSÎ, Calamunding, T.; Limoncito, Sp.; Small lemon, Eng.

CITRUS NOTISSIMA, Blanco. DAYAP, T.; Limón, Sp.; Lemon, Eng.

CITRUS RETICULATA, Blanco. NARANJITAS, Sp.; Sintones, T.; Small oranges, Eng.

CITRUS TOROSA, Blanco. CABUYAO, T., P.; Colobot, T.

CIVET BEAN or SIEVA. See *Patanê*.

CLUSTER FIG. See *Tibig na lalaqui*.

COBAG (Yam, cinnamon vine). *Dioscorea divaricata*, Blanco.

A tall, climbing plant with edible tubers. Found in northern Luzon and the Visayan Islands; and is sometimes cultivated.

COCO (Cocoanut). *Cocos nucifera*, Linn.

A palm, widely cultivated throughout the Archipelago. Wine, vinegar, and many other products are manufactured from the sap, fruit, nut, leaves, veins, etc. Copra, the principal product, is largely exported. Green fruit is used in cookery. The little oil made here is locally consumed as an illuminant, as a cooking oil, and as a hair dressing.

COCOA. See *Cacao*.

COCOANUT. See *Coco.*

COCOS NUCIFERA, Linn. Niog. T.; Coco, Sp.; Cocoanut, Eng.

COFFEA ARABICA, Linn. CAFÉ, T., Sp.; Cahawa, M.; Coffee, Eng.

COFFEE. See *Café.*

COGONTOCO. *Albizzia saponaria*, Blume.
Yields resin for lighting purposes.

COLASIMAN (Purslane, pusley). *Portulaca oleracea*, Linn.
A trailing weed found throughout the Archipelago, but not cultivated. The stem and leaves are edible and are used as a salad.

COLETES. *Amaranthus spinosus*, Linn.
A native herb, 2 to 3 feet high, found on Luzon, the Visayan Islands, etc. The ash made from the plant is used for dyeing; also used as vegetable greens in cookery.

COLIAT. *Gnetum* sp.
A small tree whose leaves and nut are edible, growing on Luzon and Panay Islands, though not cultivated.

COLIFLOR. *Brassica oleracea*, Linn. Var.
A vegetable found in Pampanga and other provinces but rarely raised. The bud is used for pickling.

COLIS. *Memecylon tinctorium*, Pers.
A tree growing spontaneously in Luzon and Visayan Islands. The leaves are used for dyeing purposes.

COLITIS. See *Coletes.*

COLO. See *Rima.*

COLOBOT. See *Cabuyao.*

COLOCASIA ANTIQUORUM, Schott. Var. Dagmay, V.; GABE, Gaby, T.; Gallang, B.; Gave, Il., Z.

COLOCASIA ESCULENTA, Schott. CALADI, V.

COLONG COLONG. *Hernandia peltata*, Meisen.
A native tree found in Luzon. Oil is made from the nut.

COMINO. See *Cilantro.*

CONDOL. *Cucurbita pepo*, Linn. Var. aspera.
An herbaceous vine, grown for local use in Luzon and other islands. The fruit is used for making sweetmeats, etc.

CONVOLVULUS REPENS, Willd. CANCONG, T.; Tancong, Tangcong, V.

CORCHORUS OLITORIUS, Linn. SALUYOT, I.

CORIANDRUM SATIVUM, Linn. CILANTRO, Comino, Sp.; Culantro, Ongsoy, T.

CORN. See *Mais.*

COROMANDEL GOOSEBERRY. See *Balimbing.*

COROT. See *Namî.*

CORYPHA UMBRACULIFERA, Linn. BURÍ, T.

CROCUS SATIVUS, Linn. DILAO, T.; Azafrán, Sp.; Saffron crocus, Eng.

CUANTON. See *Coletes.*

CUCHAY (Wild leek). *Allium tricocum*, Ait.
A bulbous plant grown in the gardens of Luzon and other islands, occasionally spontaneous in Leyte. The leaves are used for condiment.

CUCUMBER. See *Pepino.*

CUCUMIS MELO, Linn. Var. Atimon, Catimon, V.; MELÓN, Sp.; Milón, T.; Melon, Eng.

CUCUMIS SATIVUS, Linn. Calavaga, V.; PEPINO, T., Sp.; Cucumber, Eng.

CUCURBITA LAGENARIA VILLOSA, Linn. Calabasang putî, Opo, UPO, T.; White squash, Eng.

CUCURBITA MAXIMA, Duchesne. CALABASANG PULÁ, Calabasang bilog, T.; Red squash, Eng.

CUCURBITA PEPO, Linn. Var. *aspera.* CONDOL, T., Sp.

CULANTRO. See *Cilantro.*

CULUTPAMU. See *Calit-calit.*

CUNALON. *Diospyros cunalon*, DC.
A tree, the bark of which, when dried and reduced to a powder, produces a black coloring matter used by the natives for dyeing purposes.

CUPANG. *Parkia roxburghii*, G. Don.
A resin useful for illuminating is extracted from this plant.

CUSTARD APPLE. See *Anonas.*

CUTSAY. See *Cuchay.*

DAGMAY. See *Gabe.*

DALANDAN (Small oranges). See *Naranjitas.*

DALANGIAN. See *Camance.*

DALAYAP (Lemon). *Citrus medica*, Linn. var. *acida.*

A shrub grown in the gardens of Luzon Island, etc. The fruit is used for seasoning.

DALIMA (Pomegranate). *Punica granatum*, Linn.

A shrub about 10 feet high, found in Luzon, Joló, etc. The fruit is edible, but the shrub is planted in gardens rather for ornament.

DALISAY ("Almond"). *Terminalia catappa*, Linn.

A tree, 30 to 40 feet high, growing spontaneously throughout the Archipelago, often used as a shade tree. The seeds are edible and are known as native almond. The true almond is *Amygdalus amygdalus.*

DALONGDONG. See *Boloañgeta.*

DAMORTIS. See *Camachilé.*

DAMPALIT. *Sesuvium portulacastrum*, Linn.

A succulent branching herb, found in Luzon and other islands. The stems and leaves are used as a vegetable, especially for pickling.

DANCALAN. See *Bitanhol.*

DÁTILES. See *Rátiles.*

DAUA. See *Bicacao.*

DAUCUS CAROTA, Linn. Carrot, Eng.; Zanahoria, Sp.

DAYAP (Lemon). *Citrus notissima*, Blanco.

A shrub or very small tree, cultivated in the gardens of Luzon and other islands and highly prized. The fruit is used in cookery, etc.

DILAO (Saffron crocus). *Crocus sativus*, Linn.

A perennial herb, sparingly grown in Luzon and other islands. The root is used for seasoning.

DILLENIA PHILIPPINENSIS, Rolfe. Catmon, T.

DINCALIN. See *Bitanhol.*

DIOSCOREA ALATA, Linn. Ube, T.; Yam, Eng.

DIOSCOREA DIVARICATA, Blanco. Baliacag, V.; Cobag; Dulian, Il.; Obat; Paquit; Chinese potato, Yam, Cinnamon vine, Eng.

DIOSCOREA PAPILLARIS, Linn. Toñgô, Tuñgô, T.

DIOSCOREA PENTAPHYLLA, Linn. Lima, Lima-lima, Nami-conot, Sap-ang.

DIOSCOREA SATIVA, Lin. Var. Togui (?), Tugue, Tugueng pulo, T.

DIOSCOREA TRIPHYLLA, Pers. Calut, P.; Carot, Il., V.; Corot, V.; Gayos, V.; Karot, Il.; Namî, T.

DIOSPYROS CUNALON, DC. Cunalon.

DIOSPYROS DISCOLOR, Willd. Mabolo, T.; Talang, P.; Persimmon, Eng.

DIOSPYROS EBENASTER, Retz. Sapote, Zapote, T.; Persimmon, Eng.

DIOSPYROS PILOSANTHERA, Blanco. Amaga, V.; Boloñgaeta, T.; Dalongdong, V.; Persimmon, Eng.

DIPTEROCARPUS GRANDIFLORUS, Blanco. Apitong, Hapitong.

DIPTEROCARPUS MALAANONAN, Blanco. Malaanonang.

DIPTEROCARPUS PILOSUS, Roxb. Hagachac or Hagachay, V.

DIPTEROCARPUS TURBINATUS, Gaertn. Mayapis.

DIPTEROCARPUS VERNICIFLUUS, Blanco. Balao, T.; Malapahô, T., V.

DISHCLOTH GOURD. See *Patola.*

DOLICHOS ECHINULATUS, Blanco. Quibal.

DOLICHOS SESQUIPEDALIS, Linn. Camangeg (?), Il.; Camangian, P.; Otong; Sitao, T.; Long yard bean, Eng.

DOLONGIAN. See *Camance.*

DRACONTOMELUM sp. Alanihao, V.

DUJAT (Jambolan or Jambolan plum). *Eugenia jambolana*, Lam.

A tree found in both a wild and a cultivated state on Luzon and other islands. The fruit is used for dessert.

DULIAN. See *Cobag.*

EGGPLANT. See *Talong.*

ENDIBIA. See *Escarola.*

ENDIVE. See *Escarola.*

ESCAROLA (Endive). *Cichorium endivia*, Linn.

A garden vegetable raised for local consumption on Luzon, etc. The leaves are used for salad.

ESPÁRRAGO (Asparagus). *Asparagus officinalis*, Linn.

An introduced garden vegetable raised in very small quantity in Cebú, Ilocos, and Manila. The young stalks are eaten when cooked.

EUGENIA JAMBOLANA, Lam. Dujat, T.; Lombuy, V.; Lomboy, Sp.; Lumboy, T.; Jambolan or Jambolan plum, Eng.

EUGENIA JAMBOS, Linn. Tampoy, T.; Rose apple, Jamrosade, Eng.

EUGENIA MALACCENSIS, Linn. Macopa, Macupa, T.; Yambo, P.; Pomarosa, Cuba; Otaheite apple, Eng.

EUPHORIA LITCHI, DC. Alipay, T.; Alopay, Alpay, Alupay, Alupe; Lechía, Sp.

FENNEL. See *Anis estrellado.*

FICUS GLOMERATA, Roxb. Tibig na lalaqui; Cluster fig.

FICUS HISPIDA? Isis.

FOENICULUM VULGARE, Gaertn. Anis estrellado, Sp.; Fennel, Eng.

FRENCH PHYSIC NUT. See *Tuba.*

FRIJOLES. See *Azabache.*

GABE. *Colocasia antiquorum*, Schott. Var.

A perennial herb cultivated throughout the Archipelago. The fleshy roots, leaves, and young shoots are used for food. Largely used as a substitute for potatoes.

GABY. See *Gabe.*

GALLANG. See *Gabe.*

GANDA. See *Cuchay.*

GARCINIA MANGOSTANA, Linn. Mangostán, T., Sp.; Mangosteen, Eng.

GARLIC. See *Bawang.*

GAVE. See *Gabe.*

GAYOS. See *Namî.*

GAYUBANO. See *Guyabano.*

GINGELLY. See *Liñgá.*

GINGER. See *Luya.*

GLORIA (Bananas). *Musa paradisiaca ternatensis*, Blanco.

High tree-like herb, very much appreciated and cultivated extensively for its valued fruit. Common in Central Luzon.

GNETUM, sp. Coliat, T., V.

GOLDEN APPLE. See *Siruelas.*

GOOSEBERRY. See *Ibâ.*

GRANADA (Pomegranate). See *Dalima.*

GRAPE. See *Uvas.*

GROUNDNUT. See *Manî.*

GUANABANO. See *Guyabano.*

GUANABENA. See *Guyabano.*

GUAVA. See *Bayabas.*

GUAYABA. See *Bayabas.*

GUAYABANO. See *Guyabano.*

GUIJO. *Shorea guiso*, Blume.

A first-group tree, producing dark gray resin not highly esteemed, and growing in the mountains.

GUINDILLA. See *Chileng-bundoc.*

GUISANTE. See *Chícharo.*

GUTTA-PERCHA.

Gutta-percha is obtained in Mindanao and Paragua from several trees belonging to the genera *Palaquium* and *Payena.*

GUYABANO (Sour-sop, Guanabena, Suirsaak, Susakka). *Anona muricata*, Linn.

A tree, 20 feet or more in height, found in Luzon and the Visayan Islands, introduced from America. The fruit is edible and good for preserves. In season from August to October.

HABAS. See *Butinga.*

HAGACHAC or HAGACHAY. *Dipterocarpus pilosus*, Roxb.

A resinous big tree, found in Mindanao, Visayan, and Luzon Islands.

HAPITONG. See *Apitong.*

HERNANDIA PELTATA, Meisen. Colong colong, T., V.

HARUM. See *Coletes.*

HEMIDESMA INDICA (Zarzaparrilla).

HEPTAPLEURUM CAUDATUM, Vid. Limolimo.

HINCAMÁS. See *Sincamás.*

HOMALANTHUS POPULIFOLIUS, J. Grah. Balante or Balanti, V.

HOPEA PLAGATA, Vid. Yacal.

HORSERADISH TREE. See *Malungay.*

HUMAY (Rice). See *Palay.*

IBÂ (Otaheite gooseberry). *Phyllanthus distichus*, Müll.

A tall shrub or small tree, about 20 feet in height, grown in gardens. The fleshy fruit is used for pickling and preserves, and is sometimes eaten raw, although strongly acid.

IKMO (Betel). *Piper betle*, Linn.

A climbing plant, found in Luzon and other islands. It is raised to a large extent in Pasay, Rizal Province, and some other places. The leaves are used for chewing only, together with a piece of betelnut and a bit of lime. The leaves are shipped to market in split bamboo crates holding several thousand. The leaves are very carefully arranged in layers with the upper surfaces all in the same direction.

ILANG-ILANG. *Cananga odorata*, H. F. et T.

A tree, 25 to 40 feet high, found throughout the Archipelago. It is highly prized and grown for commerce, especially around Manila, Mindoro Island, etc., being valued for its flowers, which yield a fine perfume. The essence called "Ilang-ilang" is exported to France, England, China, and Singapore.

INCAMÁS. See *Sincamás*.

INDIGO. See *Tayom*.

INDIGOFERA TINCTORIA, Linn. Ameri, B., C.; Mariana, Tagom, Tagum, V.; TAYOM, T.; Tayung, P.; Añil, Sp.; Indigo, Sp., Eng.

IPOMEA BATATAS, Poir. CAMOTE, Camoti, T.; Sweet potato, Eng.

IRISH POTATOES. See *Batatas*.

IROC. See *Caong*.

ISIS. *Ficus hispida?*

The very rough-scabrous leaves of this plant are used for cleaning floors, kitchen utensils, etc. Markets of Manila.

ITMO. See *Ikmo*.

JAKFRUIT. See *Langkâ*.

JAMAICA PLUM. See *Siruelas*.

JAMBOLAN or JAMBOLAN PLUM. See *Dujat*.

JAMROSADE. See *Tampoy*.

JASMINUM SAMBAC, Linn. SAMPAGUITA.

JATROPHA CURCAS, Linn. Casla, V.; tava-tava, Tawatawa, Il.; TUBA. T.: Physic nut or French physic nut, Eng.

JATROPHA MULTIFIDA, Linn. MANÁ, T., Sp.

JENGIBRE. See *Luya*.

JINCAMÁS. See *Sincamás*.

JUSTICIA CORROSIVA, Linn. ATAY-ATAY, V.

KALAMISMIS. See *Calamismis*.

KAMÁS. See *Sincamás*.

KAMIAS (Cucumber tree). *Averrhoa bilimbi*, Linn.

A small tree raised in gardens on the Island of Luzon. The agreeably acid fruit is used for dressing, sweetmeats, etc. The trees are very productive and the fruit is valued in Manila at from 10 to 30 cents per 100.

KAROT. See *Namî*.

KATUDAY. *Sesbania grandiflora*, Pers.

A native tree, 20 to 30 feet high, growing in Luzon. The flowers are used for salad, etc., and the resin medicinally.

LABANÓS (Radish). *Raphanus sativus*, Linn.

A vegetable grown to a large extent throughout the Archipelago. The root is edible.

LABLAB CULTRATUS, D. C. BATAO, T.; Bulay, P.

LACATÁN. *Musa paradisiaca lacatan*, Blanco.

A variety of banana grown in Luzon and other islands for its fruit, which is highly prized. It is claimed to be one of the best varieties, on account of its superior flavor.

LACTUCA SATIVA, Linn. LECHUGA, Sp.; Lettuce, Eng.

LAÑGIÑGÎ. See *Calit-calit*.

LANGKÂ (Jakfruit). *Artocarpus integrifolia*, Linn. f.

A tree, 20 to 30 feet high, raised in gardens throughout the Archipelago for local consumption. The fruit, which often weighs 60 to 70 pounds, is eaten raw or cooked, and is good for preserves. The oily seeds when boiled or baked somewhat resemble chestnuts.

LANSINA. See *Tañgantañgan*.

LANSIUM DOMESTICUM, Linn. Boboa, T.: Boocan. Bulahan. T.; Lanson, V.; LANZONES, Sp., T.

LANSON. See *Lanzones*.

LANZONES. *Lansium domesticum*, Linn.

A small tree of beautiful appearance, 15 feet or more in height, found in Luzon and other islands. Cultivated to a large extent in Laguna Province. The fruit is very highly esteemed as a dessert. Exported in considerable quantities to China in bamboo baskets holding about 20 pounds. Price 1 to 2 cents per pound.

LARGE LEMON. See *Cagel.*
LASONA. See *Sibuyas.*
LATONDÁN. See *Letondal.*
LAUA-AN. See *Lauan.*
LAUAN. *Anisoptera thurifera*, Blanco.

A large tree that yields transparent, hard, and odorous resin of white-yellowish color esteemed in commerce and used as incense, the manufacture of varnishes, and for calking boats. Found throughout the Archipelago.

LAYAL (Ginger). See *Luya.*
LAYOHAN. See *Ibâ.*
LECHÍA. See *Alipai.*
LECHUGA (Lettuce). *Lactuca sativa*, Linn.

A garden vegetable locally raised throughout the Archipelago. The leaves are used for making salad.

LEERSIA HEXANDRA, Swartz. Baret, Barit, T.; ZACATE, Sp.
LEMON GUAVA. See *Bayabas.*
LETONDAL. *Musa paradisiaca cinerea*, Blanco.

A variety of banana, which is more widely cultivated in Luzon and other islands for its edible fruit. Introduced from India by a French clergyman named Mr. Letondal.

LETTUCE. See *Lechuga.*
LIMA. *Dioscorea pentaphylla*, Linn.

A vegetable growing in Luzon, Panay, Negros, Cebú, etc., though rarely cultivated. The tuberous root is edible.

LIMOLIMO. *Heptapleurum caudatum*, Vid.

Yields a resin used for making varnish.

LIMÓN. See *Dalayap* and *Dayap.*
LIMONCITOS. See *Limón suti.*
LIMÓN REAL. *Citrus medica*, Linn.

A small tree, a garden product of Luzon and Panay, valued for its fruit.

LIMÓN SUTI. *Triphasia trifoliata*, DC.

A shrub, growing spontaneously in Joló, Mindanao, Luzon, and Panay. The fruit is used for dressing, etc.

LINANCINA. See *Tañgantañgan.*
LIÑGA (Til or Teel, gingelly, beneseed). *Sesamum indicum*, Linn.

There are two varieties of sesamum grown in small quantities upon Luzon and other islands. An oil is extracted from the seeds which is used for culinary purposes. The oil is valued at about $2, gold, per gallon. A limited amount of the oil is manufactured in Bulacan Province.

LOMBOY. See *Dujat.*
LOMBUY. See *Dujat.*
LONG YARD BEAN. See *Sitao.*
LOPO. See *Calit-calit.*
LOPO-LOPO (?). See *Calit-calit.*
LUCBAN (Pomelo or Grapefruit). *Citrus decumana*, Linn.

A tree 20 to 30 feet high, several varieties of which are planted in gardens throughout the Island of Luzon, Visayas, and Mindanao. The fruit is edible, but of inferior quality.

LUCUMA MAMOSA, Gaertn. MAMEY, T.; Chico Mamey, Sp.; Marmalade plum, Eng.
LUFFA ACUTANGULUS, Roxb. PATOLA, T.; Dishcloth gourd, Eng.
LUFFA AEGYPTIACA, Mill. PATOLA, T.; Sponge cucumber, Eng.
LUMBANG. *Aleurites triloba*, Forst.

A tree of Luzon and the southern islands. The seed yields an oil which is used as an illuminant but more especially as a substitute for linseed oil by painters. The pressed cake is used as a fertilizer by florists and has a local value of $50, gold, per ton. The oil value at wholesale is 40 to 50 cents, gold, per gallon, and the nuts are valued at from $65 to $70, gold, per ton.

LUMBAY or LUMBIA. *Metroxylon silvestre*, Mart.

A palm from which a kind of flour is obtained, which serves as food to the poorer classes in times of scarcity.

LUMBOY. See *Dujat.*
LUPO. See *Calit-calit.*
LUY-A. See *Luya.*
LUYA (Ginger). *Zingiber officinale*, Linn.

A vegetable grown in Luzon and other islands for local consumption. The tuber or root is used for dressing, or as a spice.

LYCOPERSICUM ESCULENTUM, Mill. CAMATIS, T.; Tomate, Sp.; Tomato, Eng.

MABOLO (Persimmon). *Diospyros discolor*, Willd.

A native evergreen tree 12 to 15 meters high in Luzon and other islands. The edible fruit is deep crimson, and is covered with velvet-like bloom. Sometimes cultivated.

MACOPA (Otaheite apple). *Eugenia malaccensis*, Linn.

A tree about 30 feet high, a garden product of Luzon and other islands. The fruit is edible.

MACUPA. See *Macopa.*

MAIS (Corn). *Zea mays*, Linn.

A cereal, introduced from America, many varieties of which are cultivated throughout the Archipelago. The grains are utilized for food, being a staple product. Commonly marketed in the ear either loose or in strings of one hundred.

MALAANONANG. *Dipterocarpus malaanonan*, Blanco.

A large tree producing an aromatic resin used for calking.

MALAPAHÔ. See *Balao.*

MALAPILÊ or ANTENG. *Canarium gracile*, Eng.

Yields black pitch used for calking and lighting. Found throughout the Archipelago.

MALISA. See *Paminta.*

MALUNGAY (Horseradish tree). *Moringa oleifera*, Lam.

A native tree, about 15 to 25 feet high, found wild throughout almost the entire Archipelago; sometimes planted for its fruit, leaves, shoots, and roots, which are used for various purposes.

MAMEY (Marmalade plum). *Lucuma mamosa*, Gaertn.

A tall shrub growing in gardens in Laguna, valued for its fruit.

MAM-IN. See *Ikmo.*

MAMON. See *Ikmo.*

MAMPALAN. See *Mangá.*

MANÁ. *Jatropha multifida*, Linn.

A shrub growing wild in Bulacan and Rizal, though sometimes planted. The fruit is used as a purgative.

MANGÁ (Mango). *Mangifera indica*, Linn.

A tree 30 to 50 feet in height, grown to a large extent throughout the entire Archipelago. The fruit is harvested during spring and summer, and is highly esteemed for dessert, jelly making, etc.

MANGIFERA ALTISSIMA, Blanco. Pahô, Pajô, T.; Pao.

MANGIFERA INDICA, Linn. Mampalan, J., M.; Mangá, T.; Manga, Sp.; Mango, Eng.

MANGLE. See *Bakao.*

MANGO. See *Mangá.*

MANGOSTÁN (Mangosteen). *Garcinia mangostana*, Linn.

A tree growing on Joló and Mindanao Islands, and known by the name of "king's fruit." The fruit is sweet and has very delicate flavor. It is much prized.

MANGOSTEEN. See *Mangostán.*

MANGROVE. See *Bakao.*

MANÎ (Groundnut, Peanut). *Arachis hypogaea*, Linn.

An herb cultivated in Luzon and other islands for forage. The seed is edible and is used for making oil, etc. Only sparingly eaten for food.

MANIHOT UTILISSIMA, Pohl. Camoteng cahoy, T.; Adam's needle, Cassava or Yucca, Eng.

MANZANITAS. *Zizyphus jujuba*, Lam.

A tree planted in gardens in Cavite, Ilocos Norte, etc., yielding an edible fruit.

MARANTA ARUNDINACEA, Linn. Ararań, T.; Araró, V., P.

MARIANA. See *Tayom.*

MARMALADE PLUM. See *Mamey.*

MARUNGAY. See *Malungay.*

MATAVIA. See *Batavia.*

MAYAPIS. *Dipterocarpus turbinatus*, Gaertn.

A tall resin-yielding tree. Found throughout the Archipelago.

MELASTOMA POLYANTHUM, Blume. Aguisip.

MELÓN (Melon). *Cucumis melo*, Linn. var.

An herbaceous vine raised for local consumption in Panay, Luzon, etc. The fruit is valued for dessert, but is of inferior quality.

MEMECYLON TINCTORIUM, Pers. Candong, Il.; Colis, T.; Saguinsin, V.

METROXYLON RUMPHII, Mart. Bagsang.

METROXYLON SILVESTRE, Mart. Lumbia or Lumbay.

MEZONEURUM GLABRUM, Desf. Cabitcabag, Sagnit, Sapnit; Togabang, V.; Tugabang; Ugabang, V.

MICHELIA CHAMPACA, Linn. Champaca.

MIJO. See *Bicacao.*

MILÓN. See *Melón.*

MILLET. See *Bicacao.*

MIMUSOPS ELENGI, Linn. Cabiquí, T.

MOMORDICA BALSAMINA, Linn. Ampalayá, Ampalea, T.; Apale (?), Apalia, V.; Palayá, B.; Palla, Paria; Amargoso, Balsamina, Sp.; Balsam apple, Eng.

MONGO. See *Balatong.*

MORINDA TINCTORIA, Roxb. Bancuro.

MORINDA UMBELLATA, Linn. Salicsican.

MORINGA OLEIFERA, Lam. Arongay (?), Il.; Arungay (?), P.; Manungal, Balongay, Balungay, V.; Camalongay, Camalugay; Malungay, T.; Marungay, Il., V.; Horseradish tree, Eng.

MOSTAZA (Mustard). *Sinapis juncea,* Blanco.

A vegetable growing in the gardens throughout the Archipelago. The leaves and seeds are used for condiment, etc.

MUNGO. See *Balatong.*

MUNTINGIA CALABURA, Linn. Dátiles, Rátiles, T.

MUSA PARADISIACA, Linn. Var. Saguing, T.; Plátano, Sp.; Banana, Eng.

MUSA PARADISIACA CINEREA, Blanco. Letondal, Latundan, Tundalán.

M. PARADISIACA COMPRESA, Blanco. Bisco; Sabá, T.; Sabá, Iloco; Plátano, Sp.; Banana, Eng.

M. PARADISIACA LACATÁN, Blanco. Lacatán, T.; Plátano, Sp.; Banana, Eng.

M. PARADISIACA MAGNA, Blanco. Tondoc, T., V.; Tunduque, T.; Plátano, Sp.; Banana, Eng.

M. PARADISIACA MAXIMA, Blanco. Batavia, T.; Matavia, V.; Plátano, Sp.; Banana, Eng.

M. PARADISIACA SUAVEOLENS, Blanco. Buñgulan, T.; Plátano, Sp.; Banana, Eng.

M. PARADISIACA TERNATENSIS, Blanco. Gloria, T.; Taranate, P.; Ternate, T.; Plátano, Sp.; Banana, Eng.

MUSHROOM. See *Agaric.*

MUSTARD. See *Mostaza.*

MYRISTICA PHILIPPINENSIS, Lam. Anis cahoy, T.; Nuez moscada, Sp.; Nutmeg, Eng.

NAMÎ. *Dioscorea triphylla,* Pers.

A vegetable found in Luzon and the Visayan Islands. The root is eaten when cooked. In times of scarcity it becomes a staple article of food among the mountaineers. The juice is also used.

NAMI-CONOT. See *Lima.*

NANGCA. See *Lanká.*

NANGKÂ. See *Langká.*

NARANJA. See *Lucban.*

NARANJITAS (Small oranges). *Citrus reticulata,* Blanco.

A tree growing upon Luzon and other islands. The fruit is of the tangarine type and is highly prized, especially that from Laguna. It is grown commercially. The best orange grown in the Islands. In season from July to February and is valued at from 40 cents to $2 per hundred.

NATIS (?). See *Ates.*

NICOTIANA TABACUM, Linn. Tabaco, Sp., T.; Tobacco, Eng.

NIOG. See *Coco.*

NIPA. *Nipa fructicans,* Wurmb.

One of the most useful of the native plants, growing throughout the Archipelago along the banks of estuaries and rivers affected by tides. The sap or "tuba" is largely used for making wine and alcohol; the leaves for roof-making, etc. Tuba when much fermented may be used as vinegar.

NIPA FRUCTICANS, Wurmb. Nipa, Sp., T.; Sasá, T.

NUEZ MOSCADA. See *Anis cahoy.*

NUTMEG. See *Anis cahoy.*

OBAT. See *Cobag.*

OCHROCARPUS PENTAPETALUS, Blanco. Pamitlain, Pamitlatin.

OGOB. See *Rima.*

OLASIMAN. See *Colasiman.*

ONGSOY. See *Cilantro.*

ONION. See *Sibuyas.*

OPO. See *Upo.*

ORANGE. See *Lucban.*

ORAYI. See *Coletes.*

ORYZA SATIVA, Linn. Humay; Palay, T.; Arroz, Palay, Sp.; Rice, Paddy, Eng.

OTAHEITE APPLE. See *Macopa*.

OTAHEITE GOOSEBERRY. See *Ibâ*.

OTONG. See *Sitao*.

PACAC. See *Camance*.

PACHYRHIZUS ANGULATUS, Rich. Camas, B.; Hincamas, T.; Incamas, P., Pn.; Jincamas, T.; Kamas, Il.; Sincamas, T.; Ticamas, V.

PACO. Asplenium esculentum, Presl.

A common fern growing spontaneously in Luzon and other islands. The young leaves are used as a vegetable.

PACOPOL. See *Calit-calit*.

PADDY. See *Palay*.

PAGSAINGUIN or PISA. *Canarium cumingii*, Eng.

A tree found in the Archipelago whose black pitch is used for lighting and calking.

PAHÔ. *Mangifera altissima*, Blanco.

A tree produced in small quantity in Luzon and other islands. The fruit is highly prized and is utilized for pickling, etc.

PAJÔ. See *Pahô*.

PAKWAN (Watermelon). *Citrullus vulgaris*, Schrad.

An herbaceous vine grown in small quantity throughout the entire Archipelago. The fruit is used for dessert, the best being raised in Bulacan.

PALAQUIUM sp. See *Gutta-percha*.

PALAY (Rice). *Oryza sativa*, Linn.

A cereal, hundreds of varieties of which are extensively cultivated throughout the Archipelago. The grains especially are used for food, and form a staple product.

PALAYÁ. See *Ampalayá*.

PALLA. See *Ampalayá*.

PAL-LAM. See *Calamismis*.

PALLANG. See *Calamismis*.

PALMA CHRISTI. See *Tañgantañgan*.

PALO-BRASIL. See *Sibucao*.

PALO MARIA. See *Bitanhol*.

PAMINTA (Black pepper). *Piper nigrum*, Linn.

A shrub growing in Luzon and Panay Islands, though rarely cultivated at present. Formerly extensively grown in Batangas. The fruit is used as a spice.

PAMITLAIN. *Ochrocarpus pentapetalus*, Linn.

A tree growing in Northwestern Luzon. The seeds yield an oil used for illuminating purposes.

PAMITLATIN. See *Pamitlain*.

PANAO. See *Balao*.

PANARIEN. *Tacca pinnatifida*, Forst.

A shrub 6 feet or more high, cultivated in Antique, and very common in Ilocos and Zambales. The tuberous root is utilized in making a flour called "gaogao," sold in the Manila markets.

PANGAS. See *Luya*.

PAO. See *Pahô*.

PAPA. See *Batata*.

PAPAW. See *Papaya*.

PAPAYA (Papaw). *Carica papaya*, Linn.

A small tree, 20 feet high or more, of American origin, a garden product throughout the Archipelago. The fruit, which is orange-yellow when ripe, is sweet and pleasant to the taste and is used in making sauces, preserves, pickles, and for desserts, and is sometimes eaten raw.

PAQUIT. See *Cobag*.

PARAS. See *Ibâ*.

PARIA. See *Amapalayá*.

PARNARIEN. See *Panarien*.

PARKIA ROXBURGHII, G. Don. Cupang.

PARSLEY. See *Perejil*.

PASITIS. See *Chileng bundoc*.

PATANÉ (Sieva or civet bean). *Phaseolus lunatus*, Linn. var. *inamoenus*.

A climbing plant growing on Luzon and Panay Islands, etc. The seeds are used as an article of food for local consumption.

PATATA. See *Batata*.

PATOLA (Dishcloth gourd). *Luffa aegyptiaca*, Mill.

An annual tendril-climbing plant, grown as a garden vegetable throughout the Archipelago. The green fruit is edible, and is cooked like squash, or served in soups and stews. The fibrous interior of the dried fruit, when bleached, is used as a sponge for cleaning or scrubbing.

PATOLA (Sponge cucumber). *Luffa acutangula*, Roxb.

Cultivated as the preceding variety, for local consumption. The matted fibers of the strongly ribbed fruit of this variety or the preceding one is being exported from Japan for lining hats and slippers.

PATOLANG WAK (round). Same as *Luffa aegyptiaca.*

PAYENA sp. See *Gutta-percha.*

PAYONG AHAS (Agaric or mushroom). *Agaricus* sp.

An umbrella-shaped cryptogamous plant, found in Luzon and the Visayan and Mindanao Islands. The entire plant is edible. Many species of Agaricus, and genera related to them, grow spontaneously throughout the Archipelago.

PEANUT. See *Manî.*

PEAS. See *Chícharo.*

PECHAY. *Sinapis brassicata*, Blanco (?).

An herb grown as a garden vegetable in Luzon and other islands. The leaves are used.

PEPINO (Cucumber). *Cucumis sativus*, Linn.

A native cucumber of vigorous growth raised in small quantity throughout the Philippines. The fruit is of large size and excellent flavor and is used for making salad, etc.

PEREJIL (Parsley). *Apium petroselinum*, Linn.

A garden vegetable cultivated for local consumption.

PERSIMMON. See *Diospyros.*

PHALARIS CANARIENSIS, Linn. ALPISTE, Sp.; Canary grass or canary seed, Eng.

PHASEOLUS sp. AGAYAC, C.; Agayap, T., Pn.; Beans, Eng.

PHASEOLUS LUNATUS, Linn. AZABACHE, Zabache, T.; Fríjoles, Sp.; Beans, Eng.

PHASEOLUS LUNATUS INAMOENUS, Linn. PATANÊ, T.

PHASEOLUS MUNGO, Linn. BALATONG, Mungó, T.; Mongo, Sp.

PHASEOLUS VULGARIS, DC. BUTINGA, T., P.; Habas, Sp., T.; Beans, Eng.

PHYLLANTHUS DISTICHUS, Mull. Bangquiling, T.; IBÂ, T., P.; Layohan; Paras, V.; Otaheite gooseberry, Eng.

PHYSIC NUT. See *Tuba.*

PILANI. See *Pilî.*

PILÎ. *Canarium album*, Blanco.

A tree found in Southern Luzon and sometimes planted. The nut and sap are utilized, the latter being produced on a commercial scale.

PIMENTA. See *Paminta.*

PIMIENTO. See *Chile.*

PINEAPPLE. See *Piña.*

PINUS INSULARIS, Endl.

Affords resin used for illuminating purposes. Found in Luzon.

PINUS MERCUSII, Jungh.

Tree producing a resin used by Igorots for illuminating purposes.

PIÑA (Pineapple). *Ananas sativus*, Schult.

An herb raised throughout the Archipelago for the flavor of its fruit, for local consumption.

PIPER BETLE, Linn. IKMO, Itmo, T.; Mam-in, P.; Mamon, V.; Samat, P., Buyo, Sp.; Betle, Eng.

PIPER NIGRUM, Linn. Malisa, P., Il.; PAMINTA, Pimenta, T.; Pimienta, Sp.; Black pepper, Eng

PISA. See *Pagsainguin.*

PISUM SATIVUM, Linn. CHÍCHARO, T., Sp.; Guisante, Sp.; Peas, Eng.

PITCH. See *Almácigа.*

PITHECOLOBIUM DULCE, Benth. CAMACHILÉ, T.; Camanchile, T., Il.; Camansile, T.; Damortis, Il.

PLÁTANO DE MONO. *Musa paradisiaca*, Linn. var.

A variety of banana grown in some gardens on Luzon and other islands. The small round fruit is edible. The plant is also found wild in the mountains.

PLÁTANO COLORADO. *Musa paradisiaca*, Linn. var.

A variety of banana grown as a garden vegetable, the reddish fruit of which is edible.

PLÁTANO MORADO. *Musa paradisiaca*, Linn. var.
A variety of banana grown in gardens for local consumption.

POMEGRANATE. See *Dalima.*

PORAS. See *Ibá.*

PORTULACA OLERACEA, Linn. Ansiman, COLASIMAN, T.; Olasiman; Verdolaga, Sp.; Purslane, Pusley, Eng.

POTATO. See *Batata.*

PSIDIUM GUAYAVA, Linn. var. BAYABAS, Tayabas, T.; Guayava, Sp.; Lemon guava, Eng.

PSOPHOCARPUS TETRAGONOLOBUS, DC. CALAMISMIS, T.; Camaluson, V.; Kalamismis, T.; Pal-lam, Il.; Pallang; Seguidillas, T., Sp.

PUGAHAN. *Caryota urens*, Linn.
A palm producing a starch or a kind of sago of good quality.

PUNICA GRANATUM, Linn. DALIMA, J.; Granada, Sp., T.; Pomegranate, Eng.

PURSLANE. See *Colasiman.*

PUSLEY. See *Colasiman.*

QUIBAL. *Dolichos echinulatus*, Blanco.
An herbaceous vine, grown in Batangas in gardens for its edible fruit.

QUINCHAY. See *Quinsay.*

QUINSAY (Celery). *Apium graveolens*, Linn.
A garden vegetable growing throughout the Archipelago, used locally. The leaf-stalk is used for salads and dressing.

RÁBANOS. See *Labanos.*

RADISH. See *Labanos.*

RAPHANUS SATIVUS, Linn. LABANÓS, T.; Rábano, Sp.; Radish, Eng.

RÁTILES. *Muntingia calabura*, Linn.
A small tree, about 15 feet high, of American origin, growing spontaneously in Luzon. The fruit is edible, though seldom used.

RED PEPPER. See *Chile* and *Chileng bundoc.*

RED SQUASH. See *Calabasang pulá.*

REPOLLO (Cabbage). *Brassica oleracea*, Linn. var.
A vegetable raised to a large extent in Luzon Island, etc., for local use. The leaves are edible.

RHAMNUS sp. CABATETE, Il.; Cabatiti, Il., Pn.

RHIZOPHORA MUCRONATA, Lam. BAKAO, Bakawan, T.; Mangle, Sp.; Mangrove, Eng.

RICE. See *Palay.*

RICINO. See *Tañgantañgan.*

RICINUS COMMUNIS, Linn. Lansina, Linancina; TAÑGGANTAÑGAN, T.; Palma Christi, Ricino, Sp.; Castor oil plant, Eng.

RIMA. See *Antipolo.*

RIMA (Breadfruit). *Artocarpus rima*, Blanco.
A tree planted in the gardens of Luzon and other islands. When cooked the fruit is eaten, and is valued for making sweetmeats. This is the most prized of all the varieties of breadfruits; select fruits are valued at one peseta and upwards.

ROSE APPLE. See *Tampoy.*

SABÁ. *Musa paradisiaca compresa*, Blanco.
A variety of banana raised on a commercial scale throughout the Archipelago.

SABÂ ILOCO. See *Sabá.*

SACCHARUM OFFICINARUM, Linn. TUBÓ, T.; Caña dulce, Sp.; Sugar cane, Eng.

SAFFRON CROCUS. See *Dilao.*

SAGNIT. See *Cabitcabag.*

SAGUING. Native name for all kinds of bananas.

SAGUISIN. See *Colis.*

SALICSICAN. *Morinda umbellata*, Linn.
A tree, from the roots of which the natives extract a red dyestuff.

SALUYOT. *Corchorus olitorius*, Linn.
A shrub, found in Ilocos Norte, sometimes planted. The leaves are eaten when cooked.

SAMALAGUI. See *Sampaloc.*

SAMAT. See *Ikmo.*

SAMBAG. See *Sampaloc.*

SAMBAGUI. See *Sampaloc.*

SAMBALAGUI. See *Sampaloc.*

SAMPAGUITA. *Jasminum sambac*, Linn.
A plant with white, fragrant flowers, from which a highly prized essence is produced.

SAMPALOC (Tamarind). *Tamarindus indica*, Linn.
A native timber tree, 30 feet or more in height. It is grown to a limited extent in Luzon, the Visayan Islands, etc., and is valued for its fruit, the meat of which is edible and serves for making preserves, syrup, dressing, etc.

SANDANA. *Anisoptera oblonga*, Dyer.
A tree like Lauan, and grows in southern Luzon and the Islands of Leyte and Mindanao. It yields an aromatic resin.

SANDÍA. See *Pakwan.*

SANDORICUM INDICUM, Cav. SANTOL.

SANTOL. *Sandoricum indicum*, Cav.
A tall tree grown in gardens throughout the Archipelago. Valued for its fruit, which is utilized for dessert, preserves, etc.

SAP-ANG. See *Lima.*

SAPANG. See *Sibucao.*

SAPNIT. See *Cabitcabag.*

SAPOLONGAN. See *Yacal.*

SAPOTE (Persimmon). *Diospyros ebenaster*, Retz.
A tree found in Cebú, Luzon, Mindanao, and Panay Islands, though rarely planted. The fruit is edible.

SEGUIDILLAS. See *Calamismis.*

SESAME. See *Liñga.*

SESAMUM INDICUM, Linn. LIÑGÁ, T.; Ajonjolí, Sp.; Sesame, Beneseed, Gingelly, Til or Teel, Eng.

SESBANIA GRANDIFLORA, Pers. Catoday, Il.; Catuday, T.; Il.; Caturay, P., Il.; KATUDAY, Il.

SESUVIUM PORTULACASTRUM, Linn. Bilang bilang, V.; Carampalit, P.; DAMPALIT, T.; Tarumpalit.

SETARIA ITALICA, Beauv. BICACAO, V., T.; Bucacao, Il.; Daua; Mijo, Sp.; Millet, Eng.

SHOREA GUISO, Blume. GUIJO.

SIBUCAO or PALO CAMPECHE. *Caesalpinia sappan*, Linn.
A tree, 14 feet or more high, growing in Luzon and Panay Islands, which yields a red coloring material sold largely in Manila markets, and exported to China and England.

SIBUYAS (Onion). *Allium cepa*, Linn.
A vegetable grown throughout Luzon and the Visayan Islands. The bulb and leaves are used in cookery.

SIEVA or CIVET BEAN. See *Patanê.*

SILE. See *Chile.*

SINAPIS BRASSICATA, Blanco (?). PECHAY, T.

SINAPIS JUNCEA, Blanco. MOSTAZA, Sp., T.; Mustard, Eng.

SINCAMAS (Yam bean). *Pachyrhizus angulatus*, DC.
An herbaceous vine grown to a large extent in Luzon, etc. The tuber is eaten raw or cooked.

SINTONES. See *Naranjitas.*

SIRUELAS (Golden apple, Jamaica plum). *Spondias* sp.
A tree, about 25 feet in height, found nearly throughout the Archipelago, and grown for its edible fruit.

SITAO (Long yard bean). *Dolichos sesquipedalis*, Linn.
A twining plant, cultivated in gardens throughout the Archipelago. A "snap" bean of excellent quality. The young pods and ripe beans are eaten. This bean is sold in the markets by the bunch of about twenty pods, at from 2 to 4 cents, gold, per bunch. There are two varieties, one with purple, the other with green pods.

SMALL LEMON. See *Calamansî.*

SMALL ORANGES. See *Naranjitas.*

SOLANUM MELONGENA, Linn. var. TALONG, T.; Berengena, Sp.; Egg plant, Eng.

SOLANUM TUBEROSUM, Linn. BATATA, T.; Papa, Patata, Sp.; Potato, Irish potato, Eng.

SORGHUM. See *Batad.*

SORGHUM SACCHARATUM, Moench. BATAD, V.; Batag (?); Sorghum, Eng.

SOUR-SOP. See *Guyabano.*

SPONDIAS sp. Siruelas, T.; Ciruelas, Sp.; Golden apple, Jamaica plum, Eng.

SPONGE CUCUMBER. See *Patola.*

SUGAR APPLE. See *Ates.*

SUGAR CANE. See *Tubó.*

SUHÂ. See *Lucban.*

SUIRSAAK. See *Guyabano.*

SUSAKKA. See *Guyabano.*

SUSONG CALABAO. *Unona* sp.

A small native tree growing in Luzon. The scarlet fruit, which contains sweet and milky sap, is edible. It is somewhat mawkish and insipid to the taste. Of local use only.

SUSONG DAMULAG. See *Susong calabao.*

SWEET POTATO. See *Camote.*

SWEET-SOP. See *Ates.*

TABACO (Tobacco). *Nicotiana tabacum,* Linn.

An herb, 3 to 5 feet high, of American origin, growing in Luzon and the southern islands, the best being that grown in Isabela and Cagayan. Many varieties are largely produced and exported to foreign markets. The leaves are used for making cigars, cigarettes, etc.

TABACOG. See *Melón.*

TACATAC (Wild chestnut). *Castanopsis philippinensis,* Vidal.

A tree of considerable height, growing wild upon Luzon and other islands. The fruit is edible.

TACCA PINNATIFIDA, Forst. Canobong, V.; PANARIEN, P., T.; Parnarien, Il.; Tayobong, V.

TAGBAC-TAGBAC. See *Araraó.*

TAGOM. See *Tayom.*

TAGUM. See *Tayom.*

TALACATAC (Wild chestnut). *Castanopsis* sp.

A tall tree, found on Luzon and other islands, though not cultivated. The fruit is utilized.

TALANG. See *Mabolo.*

TALISAY. See *Dalisay.*

TALONG (Eggplant). *Solanum melongena,* Linn. var.

An herb, 3 feet high, cultivated as a garden vegetable, for local consumption only, throughout the Archipelago.

TAMARIND. See *Sampaloc.*

TAMARINDUS INDICA, Linn. Samalagui, Sambag, Sambagui, Sambalagui, V.; SAMPALOC, T.; Tamarindo, Sp.; Tamarind, Eng.

TAMAUIAN. See *Bitanhol.*

TAMPOY (Rose apple, Jamrosade). *Eugenia jambos,* Linn.

A tree raised as a garden product in Cebú, Luzon, and Panay. The fruit is edible and is used for making jelly.

TAÑCONG. See *Cancong.*

TAÑGANTAÑGAN (Castor oil). *Ricinus communis,* Linn.

A shrub growing spontaneously nearly throughout the Islands of Luzon, Visayas, and Mindanao, forming dense jungles. The seeds yield an oil much prized in commerce.

TANGCONG. See *Cancong.*

TAPIOCA.

A wholesome food article made from the starchy roots of Yucca or Cassava plant.

TARANATE. See *Gloria.*

TARUMPALIT. See *Dampalit.*

TAVA-TAVA. See *Tuba.*

TAWATAWA. See *Tuba.*

TAYABAS. See *Bayabas.*

TAYOBONG. See *Panarien.*

TAYOM (Indigo). *Indigofera tinctoria,* Linn.

A small leguminous shrub, about 5 feet in height, grown in Luzon and other islands. The entire plant, with the exception of the root, furnishes a blue dyestuff known as indigo, which is much used in the industries. It is also raised to a considerable extent in Ilocos and Pangasinan, where the plant is known by the name of Indigo. There are other species cultivated, as *I. trifoliata,* Linn.; *I. trita,* Linn.; *I. hirsuta,* Linn.

TAYOBONG. See *Parnarien.*

TAYUM. See *Tayom.*

TAYUNG. See *Tayom.*

TEEL or TIL. See *Liñgá.*

TERMINALIA CATAPPA, Linn. DALISAY, Talisay; Almond, Eng.

TERNATE. See *Gloria.*

THEOBROMA CACAO, Linn. CACAO, Sp., T.; Cocoa, Eng.

TIBIG NA LALAQUI (Cluster fig). *Ficus glomerata*, Roxb.

A shade tree, growing by the streams, on Luzon. The fruit is small and is much relished by children, and also by cattle. The tree is highly valued by the natives for the reason that the roots yield drinking water.

TICAMAS. See *Sincamas.*

TIPOLO. See *Antipolo.*

TOBACCO. See *Tabaco.*

TOGABANG. See *Cabitcabag.*

TOGUE.

The first sprouts of the Balatong (*Phaseolus mungo* L.) are so called, which are eaten when cooked as a vegetable, and are indigestible.

TOGUI (?). See *Tugue.*

TOMATES. See *Camatis.*

TOMATO. See *Camatis.*

TONDOC. See *Tunduque.*

TOÑGÔ. *Dioscorea papillaris*, Linn.

A vine found wild, but sometimes planted for its edible root or tuber.

TRIGO (Wheat). *Triticum vulgare*, Willd.

A cereal grown in Batangas, Cagayan, Cavite, and Ilocos Norte, though rarely planted at present. The grain is used for making flour, which is made into bread.

TRIPHASIA TRIFOLIATA, DC. Limon suti; Limoncitos, Sp.

TRITICUM VULGARE, Willd. Trigo, Sp.; Wheat, Eng.

TUBA (French physic nut). *Jatropha curcas*, Linn.

A native shrub, about 8 feet high, found wild and planted for fences throughout Luzon and other islands. The fruit is used for making oil, and is purgative.

TUBA. A sweet liquid extracted either from the peduncle or fruit of many palms, such as: Nipa, cocoanut, buri, caong, pugahan, etc. Tubâ is a favorite drink of the natives, and is made into sugar, wine, alcohol, and vinegar, forming one of the important native industries.

TUBÓ (Sugar cane). *Saccharum officinarum*, Linn.

A tall grass, 8 to 15 feet high, several varieties of which are extensively cultivated throughout the Archipelago, especially in Pampanga and Negros. Sugar made from the juice of the stalks forms a staple product which is largely exported. The stalks are also marketed in large quantities for eating. They are sold in bundles of about a dozen stalks for 20 to 30 cents, gold, per bundle.

TUGABANG. See *Cabitcabag.*

TUGUE. *Dioscorea sativa*, Linn. var.

A vine grown as a garden vegetable, in Luzon and other islands. The tuberous root is edible.

TUGUENG PULO. See *Tugue.*

TUNDALÁN. See *Letondal.*

TUNDUQUE (Banana). *Musa paradisiaca magna*, Blanco.

A variety of banana tree, grown on a small scale in Luzon and other islands as a garden product. The large fruit is edible.

TUÑGÔ. See *Toñgô.*

UBE. *Dioscorea alata*, Linn.

A climbing herb growing on Luzon and other islands, sometimes raised to a large extent. The tuber is used as an article of food.

UGABANG. See *Cabitcabag.*

UNONA sp. Susong calabao, T.; Susong damulag, P.

UPO (White squash). *Cucurbita lagenaria villosa*, Linn.

A staple garden vegetable throughout the Archipelago. The fruit sometimes exceeds one meter in length, and the price is governed by the size. Quality said to be excellent.

UVAS (Grape). *Vitis* sp.

A vine raised or planted in gardens in Albay, Ilocos Norte, etc., but rather for ornament than for fruit. The fruit is, however, used.

VATICA MANGACHAPUY, Blanco.

A tree of medium size, which yields resin.

VEGETABLE WAX. It is found in Calamianes, Paragua, etc.

VERDOLAGA. See *Colasiman.*

VITIS sp. Uvas, Sp.; Grape, Eng.

WATERMELON. See *Pakwan.*

WHEAT. See *Trigo.*

WHITE SQUASH. See *Upo.*

WILD CHESTNUT. See *Tacatac* or *Talacatac.*

YACAL. *Hopea plagata*, Vidal.
A lofty tree yielding transparent resin.

YAM. See *Cobag.*

YAM BEAN. See *Sincamas.*

YAMBO. See *Macopa.*

YLANG-YLANG. See *Ilang-Ilang.*

YUCCA. See *Camoteng cahoy.*

ZABACHE. See *Azabache.*

ZACATE. *Leersia hexandra*, Swartz.
A grass which is cut by hand and sold green for feed for horses. An important industry in Manila.

ZANAHORIA. *Daucus carota*, Linn.
An herb cultivated for local use in Camarines, Cavite, Cagayan, etc. The root is edible.

ZAPOTE. See *Sapote.*

ZARZAPARRILLA (sarsaparilla).
The Indian sarsaparilla is grown locally for medicinal use.

ZEA MAYS, Linn. Mais, T.; Maiz, Sp.; Corn, Eng.

ZINGIBER OFFICINALE, Linn. Baseng, Il.; Loyal, M.; Luya, T.; Luy-a; Pangas, M.; Jengibre, Sp.; Ginger, Eng.

ZIZYPHUS JUJUBA, Lam. Manzanitas, Sp., T.

A list of Philippine fiber plants.

[The species in the following list are arranged alphabetically by their Latin or scientific names by F. Lamson-Scribner, Chief of the Insular Bureau of Agriculture.]

Scientific and local or native names.	Distribution.	Part used.	Uses, etc.
Abroma angusta Linn. (Sterculiaceæ). Anabó, T., B., V., Il.; Anabu, P.; Anafu, Il.; Anagbo, V.; Annabo, Z., Pn., Il.; Devil's Cotton, Eng.; Nabo, V.; Tanabo, V.	Luzon and the Visayan Islands.	Inner bark	Twine, thread, ropes, fishing lines, pouches, etc. Fiber compares favorably with jute; 2 meters long; $4, Mexican, per picul.
Abroma sp. (Sterculiaceæ) Cáñamo, Sp.; Lapnit, Il.	Northern Luzon	do	Twine, ropes, etc.
Abutilon indicum (Malvaceæ) Malva, Sp., T.	Luzon and the Visayan Islands.	Bark	Ropes.
Agave rigida Mill. (Amaryllidaceæ). Amaguey, Pn.; Magay, V.; Maguey, T., Il.; Henequen (Mex.); Pita, Sp.; Sisal Hemp, Eng.	Northern Luzon southward to Iloilo and western Negros.	Leaves	Ropes, twine, etc.; raised commercially in Ilocos Norte; 800 to 1,000 plants per hectare; yield 10 piculs per hectare; $5 to $8, Mexican, per picul.
Alstonia sp. ? (Apocynaceæ) Jinguio, T.	Batangas and Camarines.	Stem	Used in making fish corrals.
Anamirta cocculus, Wight et Arn. (Menispermaceæ). Labtang, Il.; Suma, P.	Union and Pampanga.		Used tying and binding.
Ananas sativa Linn. (Bromeliaceæ). Pineapple, Eng.; Piña, Sp., T., etc.	Luzon, Visayan, and Mindanao Islands.	Fiber from leaves.	Fine cloths, dress goods, shirts, etc.; six leaves yield 1 ounce fiber, more or less.
Andropogon acicularis Spr. (Gramineæ). Morisico, V.; Morosico, Mursicos, T., V.	Bohol and Masbate Islands, etc.	Straw	Hats and mats.
Anisoptera thurifera Blanco (Dipterocarpaceæ). Lauan or Lauaan, V.	Visayan Islands	Inner bark	
Anona reticulata Linn. (Anonaceæ). Anonas, Sp., T.	Luzon Island	do	Cordage.
Areca catechu, Linn. (Palmæ). Betelnut, Eng.; Bonga, Buñga, T.; Bonga, Sp.	Luzon and other islands.	Bark of the fruit.	Brown paper.
Artocarpus camansi Blanco. (Moraceæ). Pacac, Il.; Camance, Camansi, V.; Dalangian, Dolongian, Il.	do	Inner bark; very strong fiber.	Cordage.
Artocarpus incisa Linn. (Maraceæ). Antipolo, Rima, T.; Tipolo, P., V.; Tipoo, V.	do	Inner bark	Twine.
Artocarpus sp. (Moraceæ) Tugop, V.	Capiz	do	

A list of Philippine fiber plants—Continued.

Scientific and local or native names.	Distribution.	Part used.	Uses, etc.
Bambusa arundo L. (Gramineæ). Bokawe, Bucawe, T.; Caña, Sp.; Bamboo, Eng.	All islands	Outer portion of stem.	Lattice work, etc.
Bambusa blumeana R. and S. (Gramineæ). Kawayan, T. (generic name for bamboo); Caña, Sp.; Bamboo, Eng.; Quian, P.	do	do	Posts, rafts, etc., of native houses, and hats, cigar and cigarette cases, etc.
Bambusa vulgaris Wendl. (Gramineæ). Caña de China, Sp.; Kawayang China, T.	Luzon Island	Stem	Ornament and making fancy furniture; yellow and green striped species.
Bambusa sp. (Gramineæ):			
Quian Bical, P	Pampanga	do	Construction of houses, fences, etc.
Quian Bañgin	do	do	Do.
Bojo, T., P	Luzon and other islands.	do	Do.
Butong, V	Negros Island	do	Do.
Calangsi, V	do	do	Do.
Kawayang Kiling, T.; Quian Kiling, P.	Luzon and other islands.	do	Do.
Quian Timbu	Pampanga	do	Do.
Bauhinia scandens Blanco (Leguminosæ). Banhot, V.; Banot, T.	Luzon, Negros, and other islands.	Inner bark	Ropes, cords, bowstring.
Bauhinia tomentosa Linn. (Leguminosæ). Salibangbang, Alibanban, T., V.; Balibanban, Marulinao, Diis, Ahihiro, Alambihor, Alibihil, P.	Luzon and the Visayan Islands.	Bark	Cordage.
Beaumontia sp. ? (Apocynaceæ). Hinguio, Jinguio, B., T.	Batangas, Camarines, Tayabas, etc.	The vine-like stem.	Fish nets and corrals, $1, Mexican, per arroba.
Boehmeria nivea Gaud (Urticaceæ). Ramie, Eng.; Ramio, Sp.	Albay, Negros Occidental, etc.	Bark	
Boehmeria sp. ? (Urticaceæ):			
Cagay, V	Negros Occidental		
Lapnis, V., T	Camarines, Tayabas, etc.	Bark	Twine.
Bombax malabaricum DC. (Bombacaceæ). Malabulac, Maracapas, Il., T., Z.	North and central Luzon.	Inner bark	Ropes, stuffing, cigar cases, etc.
Calamus albus[a] Nav. (Palmæ) Bejuco, Sp.; Calapi, V.; Rattan, Eng.	Masbate, Sorsogon, etc.	Stem	Canes.
Calamus buroensis Nav. (Palmæ). Talola, Talora, T., V.; Bejuco, Sp.; Rattan, Eng.	Southern Luzon	do	Beds, chairs, lashings, ropes, etc.
Calamus coccineus Nav. (Palmæ). Bejuco, Sp.; Ouay na pula, Z.; Rattan, Eng.	Zambales and other provinces.	do	General uses of rattan.
Calamus equestris Nav. (Palmæ). Bejuco, Sp.; Ouay, T.; Rattan, Eng.	Bataan, Bulacan, etc	do	Bags, hats, jewel cases, etc.
Calamus haenkeanus Nav. (Palmæ). Bejuco, Sp.; Ditaan, Z.; Rattan, Eng.	Luzon Island	do	Binding, lashings, etc.
Calamus horrens Blume (Palmæ). Bejuco, Sp,; Rattan, Eng.; Tagnictic, V.	Negros Occidental	do	General uses of rattan.
Calamus javensis Nav. (Palmæ). Bejuco, Sp.; Apis, Z.; Rattan, Eng.	Zambales	do	Binding, lashings, etc.
Calamus maximus Blanco (Palmæ). Bejuco, Sp.; Calapé Calapi, Calupe, V.; Palasan, Parasan, T., V.; Rattan, Eng.	Luzon and the Visayan Islands.	do	Cord, chairs, beds, canes, etc.

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[a] This variety is probably the same as Calamus maximus.

A list of Philippine fiber plants—Continued.

Scientific and local or native names.	Distribution.	Part used.	Uses, etc.
Calamus pisecarpus Nav. (Palmæ). Bejuco, Sp.; Limoran, T.; Rattan, Eng.	Bataan, Tayabas	Stem	Bindings and lashings.
Calamus scipionium Nav. (Palmæ). Bejuco, Sp.; Bucton, Buton, V.; Rattan, Eng.	Masbate	do	Do.
Calamus sp. (Palmæ):			
Aangan, V	Negros Occidental	do	General uses of rattan.
Alimorran, T	Bataan	do	Do.
Anasag, V	Bohol	do	Do.
Apas, T	Batangas	do	Do.
Bacbaquin, P	Tarlac	do	Do.
Bagacay, V	Bohol, Negros Occidental.	do	A superior variety of rattan; used in manufacture of sieves.
Baganito, B	Albay	do	Uses of rattan.
Bahuca, B.[a]	do	do	
Balagacay, V	Negros Occidental	do	Do.
Balanog, T	Tayabas	do	Do.
Balugaco, V	Marinduque	do	Do.
Barit?, Il., Z	Luzon Island	do	Large hats, tying purposes, canes.
Barret, C	Northern Luzon	Red stem	Used in construction of houses.
Barrit, Il	do	do	Used for binding in construction of houses.
Basag, V	Antique	Stem	General uses of rattan.
Batarag, Pn	Pangasinan	do	Do.
Batlit, Z	Zambales	do	Do.
Bauban, V	Antique	do	Do.
Bejuco, Sp.[a]	All islands	do	Do.
Bimnarit, Pn	Pangasinan	do	Do.
Bogtongin, T	Tayabas	do	Do.
Bolongan, V	Negros Occidental	do	Do.
Borobagacay, B., V	Southern Luzon	do	Do.
Bot-ungan, T	Batangas	do	Do.
Butongan, T	Luzon Island	do	Do.
Bugting, V	Negros Occidental	do	Do.
Bulalat, B	Zambales	do	Do.
Caragad, B	Albay	do	Do.
Cayape, M	Surigao	do	Do.
Culacling, T	Nueva Ecija	do	Chairs, etc.
Culading, T	do	do	Do.
Daanan, T	Tayabas	do	Uses of rattan.
Danán, B	Albay	do	Do.
Dahonuay, T	Bulacan	do	Do.
Dietan, T	do	do	Do.
Domaracá?, Il	Union	do	"Salacots," native large hats.
Dumayaca, T	Batangas	do	Weaving nipa.
Gatasan, T	Luzon and the Visayan Islands.	do	General uses of rattan.
Halamham, V	Negros Occidental	do	Do.
Hoag, V	Romblon	do	Tying or lashing in house building.
Ilouag, V	Visayan Islands		
Iruad, Il	Benguet		
Jamuy, Z	Zambales	Stem	Chairs and fish corrals.
Janamjam, V	Bohol	do	General uses of rattan.
Jipguid, V	Iloilo	do	Fish traps.
Joag, V	Negros Occidental	do	Tying or lashing in house building.
Juag, V	Bohol	do	Roofing and fish corrals.
Juay, V	Luzon and other islands.		
Labing, B	Southern Luzon	Stem	Tying, baskets, chairs, lattice, window blinds.
Labney, Pn	Pangasinan		
Labnig, B	Southern Luzon	Stem	General uses of rattan.
Lambotan, T	Tayabas		
Lamuran, T	Bulacan		
Lauaybaboy or Samulid, T.	Batangas		
Lilimbuyen, Pn	Pangasinan		
Lipat-lipat, V	Negros Occidental	Stem	Used for making canes, ropes, furniture, etc.
Lipay, T	Tayabas		
Locoan, V	Masbate	Stem	Binding and lashing.
Lontoc, V	Negros Occidental		
Lucuan, V	Masbate		
Lum-an, V	do		
Magabay, V	Romblon	Stem	Tying and binding.
Magbagacay, V	Negros Occidental		

[a] Generic name for rattan.

A list of Philippine fiber plants—Continued.

Scientific and local or native names.	Distribution.	Part used.	Uses, etc.
Calamus sp. (Palmæ)—Cont'd.			
Magtaguictic, V	Masbate	Stem	Chairs.
Malabotong, V	Negros Occidental		
Malagoquing, V	do		
Mambotan, T	Tayabas	Stem	Binding and lashing.
Mamugtung, P	Tarlac	do	Cordage.
Mamunting, P	do	do	Do.
Mangnao, V	Negros Occidental	do	Binding and lashing.
Mungao, C	Cagayan	do	General uses of rattan.
Nacot, B	Southern Luzon	do	Binding and lashing.
Nag, B	do	do	Do.
Nanga, V	Romblon	do	Do.
Napus, B	Camarines	do	Ropes.
Nicop, B	Southern Luzon		
Nicot, B	do		
Nocot, B	do	Stem	Tying purposes.
Nocotnag, B	do	do	Do.
Oay, B., T., Il	Luzon and other islands.	do	Ropes, chairs, etc.
Oey, Pn	Pangasinan		
Oay-babae, V	Masbate		
Oay-babai-ye, M	Surigao		
Olas, B	Camarines		
Paalis, T	Tayabas		
Padlos, B	Camarines	Stem	Lattices.
Pudlos, V., M	Visayan and Mindanao Islands.		
Pait, B	Camarines		
Palanoc, B	Albay, Camarines	Stem	Canes.
Palimanao, T	Bulacan		
Panlis, T	Tayabas		
Panlitocan, V	Negros Occidental		
Pansilanon, V	do		
Pasan, V	Bohol		
Payasan, M	Surigao		
Pusi, Il	Abra	Stem	Whips, canes.
Querquersang, Il	Union		
Red Rattan, Eng	Zambales	Stem	Cordage.
Remoran, V., B	Southern Luzon and the Visayan Islands.		
Remuran, V	Masbate		
Sadat, Il	Union		
Saja-an, V	Negros Occidental		
Sajajan, V	Masbate		
Samolig, B	Southern Luzon	Stem	Canes.
Samulig, B	do	do	Do.
Sangumay, T	Rizal Province	do	Hats, chairs, twine.
Sarmientos, V	Antique, Negros Occidental.		
Siag, B	Albay		
Sig-id, V., M	Surigao, Negros Occidental.	Stem	Tying purposes.
Sigid, V	Bohol	do	Fish corrals.
Tagsaon, V	Masbate		
Tagsahon, M	Surigao		
Tagolaoay, V	Bohol		
Taguiti, V	Negros Occidental		
Talaran, V	do		
Talipupoc, T	Bulacan		
Talolo, V	Marinduque		
Talonton, V	Negros Occidental		
Tamalola, V	do	Stem	Binding and lashing.
Tamalura, V	do	do	Do.
Tamarura, V	Romblon		
Tanamjam, V	Negros Occidental		
Tandalora, B., V	Albay, Masbate		
Tandarora, B	Albay		
Tandarura, V., B	Southern Luzon, etc.		
Tararura, B	Camarines		
Tapniguid, M	Surigao		
Tatula, T	Batangas		
Tinalintin, T	Tayabas		
Tocong, Pn	Pangasinan		
Tomarom, V., B	Sorsogon		
Tumaguictic, V., B	Masbate, Sorsogon, etc.		
Tumalim, T	Southern Luzon	Stem	Do.
Tumalon, V	Romblon		
Tumarom, B	Southern Luzon	Stem	Chairs, hammocks, traveling bags, etc.
Uag, B	Albay		

A list of Philippine fiber plants—Continued.

Scientific and local or native names.	Distribution.	Part used.	Uses, etc.
Calamus sp. (Palmæ)—Cont'd.			
Uay, T.	Luzon and other islands.	Stem	Hats, pocket cases, and other articles.
Uay-babae, V., B	Sorsogon		
Ubao, B	Camarines	Stem	Ropes.
Uban-uban, B	do		
Uii, Z	Zambales		
Uway, T	Abra, Bulacan, Rizal, etc.	Stem	Tobacco pouches, hats, baskets, chairs, pocketbooks, traveling bags, jewel cases, etc.
Yanktok, T [a]	All islands		
Callicarpa cana Linn. (Verbenaceæ). Hanagdong, V.	Negros Occidental	Inner bark	Cordage.
Callicarpa sp. (Verbenaceæ) Hinguio, T.	Laguna		
Caryota onusta Blanco (Palmæ). Caong, P., T.; Edioc, V.	Luzon, Masbate, and other islands		
Caryota urens L. (Palmæ) Anibong, T.; Cabonegro, Sp.; Idioc, eruc, V.; Idiok, B.; Iroc, ,T.; Jidioc, V.	Luzon and other islands.	Leaves and fiber surrounding stem, which is called "cabonegro."	Strong rope, twine, etc.
Caryota sp. (Palmæ) Darumacá?, Il., Pn.	Ilocos Norte and Pangasinan.	Leaves	Large hats.
Ceiba pentandra Gaertn. (Bombacaceæ). Algodoncino, Sp.; Bobuy, Bulac doldol, Bulac dondol, V.; Capas, Capas ñga babaret, Pn.; Capasanglai, Pn., Il.; Capoos, Pn.; Cayo, B.; Cotton, Eng.	Luzon and other islands.	Fiber on seeds	Stuffing pillows, mattresses, etc.
Clerodendron intermedius, Cham. (Verbenaceæ). Colo-co-lot, Pn.	Pangasinan		Pouches.
Cocos nucifera Linn. (Palmæ). Coco, Sp.; Cocoanut, Eng.; Niog, T.	All islands	Covering of nut, leaves, and veins.	Brushes, ropes, coarse cloth etc.
Columbia serratifolia DC. (Tiliaceæ). Alinao, Il.; Anilao, T., V.; Anilo, Anulo, P.; Linao, V.	Luzon and the Visayan Islands.	Inner bark	Cordage, twine, rope, etc.
Corchorus acutangulus Linn. (Tiliaceæ). Saluyot, Il., Pn., T.	Northern Luzon	do	Cordage, rope, etc.
Corchorus olitorius Linn. (Tiliaceæ). Pasao, T., P.	Luzon	Inner bark extracted by maceration.	Sacks, ropes, harnesses for working animals.
Cordia blancoi Vidal (Borraginaceæ). Sinaligan, Il.	Abra	Inner bark	Cigar cases.
Cordia myxa Linn. (Borraginaceæ). Anonang, B.	Southern Luzon	do	Cordage.
Corypha minor Blanco (Palmæ). Anaao, Il.; Anahao, P., V.; Anahaw, V., T.; Anao, P.	Luzon and the Visayan Islands.	Leaves	Hats, cloaks, fans, mats, etc.
Corypha umbraculifera Linn. (Palmæ). Bolí, Bulé, T. P.; Bulí, T., M.; Burí T.; Silac, Silag, Il., Pn.	All islands	Leafstalk, leaves.	Hats, mats, sacks, ropes, brooms, clothes chests, baskets, bags, pocket cases, etc.; buntal hats made of the leaf-stem fiber.
Crinum asiaticum Linn. (Amaryllidaceæ). Bacong, V.	Visayan Islands	Inner bark	Twine, rope.
Cyathula prostata Blume (Amarantaceæ). Amorseco, Sp., T.; Variri, V.	Luzon and other islands.		
Cyperus difformis Linn. (Cyperaceæ). Bangkwang?, T.	Rizal	Leaves	Hats, mats, strings.

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[a] Generic name for rattan.

A list of Philippine fiber plants—Continued.

Scientific and local or native names.	Distribution.	Part used.	Uses, etc.
Dendrocalamus flagellifer Munro (Gramineæ). Bojo, T., Il.	Luzon	Outer part of stalk.	Hats, baskets, etc.
Desmodium gangeticum and diversifolium, DC. (Leguminosæ). Mangquit, T.	Tayabas		
Entada scandens Benth. (Leguminosæ). Gogo, T.; Balogo, Bayogo, V., P.	Luzon and the Visayan Islands.	Bark	Cleaning the hair, hairy skins, lather, etc.; the fiber is saponaceous.
Ficus indica Linn. (Moraceæ). Balete, B., T.; Batiti, V.	do	Inner bark	Ropes.
Ficus macrocarpa Linn.? (Moraceæ). Payapa, V.	Visayan Islands	do	
Flagellaria indica Linn. (Flagellariaceæ). Balanguay, P.; Balinguay, T.; Balingnuay, T.	Luzon	do	Twine.
Gnetum gnemon Linn. (Gnetaceæ). Bago, V.; Caliat, Pn.; Culiat, P.	Luzon and the Visayan Islands.	do	Cordage, twine, cigar cases.
Gnetum latifolium Blume (Gnetaceæ). Salago, V.	do	do	Cordage.
Gnetum scandens Roxb. (Gnetaceæ). Colias, T.	Central Luzon	Stem	Do.
Gossypium arboreum Linn. (Malvaceæ). Bulac cahoy, T.; Algodon, Sp.; Tree Cotton, Eng.	Luzon and other islands.	Lint on seeds.	Pillows, mattresses, fishline, candlewick, reins, whips, etc.
Gossypium barbadense Linn. (Malvaceæ). Janovitch Cotton, Eng.[a]	Negros Occidental	do	
Gossypium herbaceum Linn. (Malvaceæ). Algodon, Sp.; Bulac castilâ, T.; True Cotton.	Luzon and other islands.	do	Cloths, etc.; grown specially in Ilocos Norte.
Grewia laevigata Vahl. (Tiliaceæ). Dangli, Danli, T.; Danglin, T.	Luzon	Inner bark	Twine, cordage, cigar cases.
Grewia multiflora Juss. (Tiliaceæ). Dangli, T.	do	do	Twine.
Harrisonia benettii A. W. Benn (Simarubaceæ). Bacnit, V.	Panay		Hats.
Helicteres sp. (Sterculiaceæ). Baquembaques, Baquinbaquit, Il.	Northern Luzon	Inner bark	Twine.
Hibiscus abelmoscus Linn. (Malvaceæ). Castuli, T.	Central Luzon	Bark	Cordage.
Hibiscus tiliaceus Linn. (Malvaceæ). Balibago, T., V.; Impid, B.; Malabago, V. Z.; Malibago, T.; Malobago, V. Pn.; Malubago, V., P.	Luzon and the Visayan Islands.	Inner bark	Cordage, twine, fine textiles, rain coats, cigar cases, etc.
Hibiscus sp. (Malvaceæ). Balibago Agpui, B. Albu, B. Batian, B. Catilpuc, B. Catipu, B. Cuayan, B Late, B. Metu, P.; B. Puti, T.; B. Tapitac, P.	Central Luzon	do	Cords, ropes, fine textiles.
Hibiscus sp. (Malvaceæ). Ragnivdin, B.	Camarines	do	Hats, mats, pocket cases baskets, etc.
Hyptis capitata Jacq. (Labiatæ). Lingo-lingo.	Southern Luzon		Hats, mats.
Ichnocarpus sp. (Apocynaceæ). Jipguid, V.	Iloilo		Fish nets.
Kleinhovia hospita Linn. (Sterculiaceæ). Bitnong, Pn.; Tanag, T., P.; Tan-ag, B.	Luzon and the Visayan Islands.	Inner bark Fiber obtained by maceration.	Cordage, twine, cigar cases, etc.

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[a] Introduced by the Bureau of Agriculture.

A list of Philippine fiber plants—Continued.

Scientific and local or native names.	Distribution.	Part used.	Uses, etc.
Litsea sp.? (Lauraceæ) Bacau, B.	Camarines		Blankets, and also clothing.
Lygodium sp. (Filices) Agnayas, Hagnayas, Tagnaya, V.	Visayan Islands	Stems	Fish nets and fish corral.
Lygodium scandens (Filices) Nito, Ngito, T.; Climbing Fern.	All islands	Stems and cortex.	Fine hats, mats, cigar cases, etc.
Macaranga sp. (Euphorbiaceæ). Guinabang, T.	Nueva Ecija		
Malachra bracteata, Cav. (Malvaceæ). Labog-Labog, V.	Negros Occidental		Roofing.
Melochia arborea Blanco (Sterculiaceæ). Balitnong, V.	do	Inner bark	Twine.
Melodorum sp. (Anonaceæ) Amuyong, T.	Nueva Ecija	Bark	
Mezoneurum procumbens Blume (Leguminosæ). Togabang, V.	Negros Occidental		
Morus alba Linn. (Moraceæ) Demoras, V.; Moras, V., T.	Luzon and the Visayan Islands.	Stalks	Hats, mats, etc.
Musa paradisiaca Linn. var. (Musaceæ). Botohan, B.; Butuhan, T., B.; Banana, Eng.; Plátano, Sp.	All islands	Leaf stalks	Hats, mats, cloths called "sinamay."
Musa paradisiaca Linn. var. (Musaceæ). Sab-a, V.; Saba, T.; Banana, Eng.; Plátano, Sp.	do	do	Weaving purposes.
Musa paradisiaca [a] Linn. var. (Musaceæ). Banana, Eng.; Plátano, Sp.; Tindoc, B., V.; Tundoc, Z.; Tunduque, V., T.	Luzon and the Visayan Islands.	do	Ropes, cordage, etc.
Musa textilis, Nees (Musaceæ). Abacá; Manila Hemp, Eng.	All islands	Leaf stalks and sheaths.	Clothing, fish nets, hats, cords, cables, etc.
Musa sp. (Musaceæ):			
Abacá cantong, B	Albay	do	General uses of Manila hemp; fine white fiber.
Abacá negro, Sp	Capiz	do	Do.
Abacá ñga alamay, M	Misamis	do	Do.
Abacá ñga bicad, M	do	do	Do.
Abacá ñga lamb, M	do	do	Do.
Abacang puti, V	Negros Occidental	do	Do.
Agotay, V	Masbate	do	Do.
Agutay, V	Romblon	do	Do.
Amucao, Z	Zambales	do	Do.
Avaja, C	Cagayan	do	Do.
Babaunón, M	Surigao	do. [b]	Do.
Bagacayon, B	Albay	do	Do.
Binangcusang, T	Tayabas	do	Do.
Bisaya, V	Negros Occidental	Leaf stalks and sheaths.	Fiber coarse, strong, white, brilliant; yield abundant.
Bognoráron, B	Albay	do	General uses of Manila hemp.
Bolonganon, V	Negros Occidental	do	Do.
Bo-y, Il	Abra, Union	do	Do.
Cadiznon, V	Negros Occidental	do	Do.
Cagnisan, V	do	do	General use of Manila hemp especially cloths.
Calibo, B	Albay	do	General use of Manila hemp.
Camarines, V	do	do	General use of Manila hemp-fiber strong; manipulation easy.
Canalajon, V	Romblon	do	General use of Manila hemp.
Cantong, Pn	Pangasinan	do	Do.
De Pepita, Pn	do	do	Do.
Ebeb, Pn	do	do	Do.
Gutay, V	Romblon	do	Do.
Hajason, V	do	do	Do.
Ilajon, V	do	do	Do.
Inasufre, T	Tayabas	do	Do.
Inisarog, B	Albay	do	Do.
Isarog or Montes, B	Camarines	do	Do.
Kala-ao, V	Negros Occidental	Sheaths of the leaves.	Do.
Kanaraon, B	Albay	do	Do.

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[a] This variety produces the well-known "abacá quilot."

[b] 5½ yards long.

A list of Philippine fiber plants—Continued.

Scientific and local or native names.	Distribution.	Part used.	Uses, etc.
Musa sp. (Musaceæ)—Cont'd.			
Kinisol, V	Negros Occidental	Sheaths of the leaves.	General use of Manila hemp; manipulation easy.
Lacatan		do	Do.
Lanesid, M	Mindanao	do	General use of Manila hemp, and also cloths.
Lanisid, V., M	Negros Occidental and Surigao.	do	Do.
Lanisip, V	Masbate	do	General use of Manila hemp.
Lanooté, Pn	Pangasinan	do	Do.
Lanot, M	Misamis	do	Do.
Lono, V	Negros Occidental	do	Do.
Mayquidit, B	Camarines	do	Do.
Moro, V	Negros Occidental	do	General use of Manila hemp; manipulation difficult; fiber excellent.
Ozanay, Il	Ilocos Norte	do	Wild banana.
Pakol, V	Southern Luzón and Visayas.	do	Fiber 4 meters long; of little value.
Patungal		do	
Pitogo, V	Bohol	do	
Poonan, M	Surigao	do	
Pliegues or Totoo, V	Romblon	do	
Putian, M	Surigao	do	Cloth and rope making.
Quidit, B	Camarines	do	
Retondan, V	Bohol	do	
Sabá, T., V., B	Southern Luzon and Visayas.	do	Cloths called "sinamay."
Sabaon, V	Antique	do	
Salawag, V	Negros Occidental	do	Cordage, etc.
Samina, B., V	Albay, Masbate, etc	do	
Samoro, V	Visayas	do	
Samorong itom, B	Albay, Camarines	do	
Samorong pula, B	do	do	
Samorong puti, B	do	do	
Samponganon, M	Misamis	do	Ropes, etc.
Sinibuyas, T	Tayabas	do	
Sugutong n̄ga Pacol, V	Capiz	do	
Tabuno, V	Romblon,	do	
Tanca-ao, V	Negros Occidental	do	
Tangalan, V	Capiz	do	
Tapaz, V	do	do	
Tinagac, V	do	do	
Tinabuno, V	Negros Occidental	do	
Tinanbuno, V	do	do	
Tomatagakanon, B	Albay	do	
Tood, M	Surigao	do	
Torancog, B	Albay	do	Sinamay.
Tubacanon, V	Capiz	do	
Umambac, V	Negros Occidental	do	
Nipa fructicans Wurmb. (Palmæ). Sasá T.; Nipa, Sp.	All islands	Leaves	Thatch, etc.
Octomeles sumatrana Miq. (Datiscaceæ). Bilua, T.	Nueva Ecija	Bark	
Oryza sativa Linn. (Gramineæ). Palay, T.; Rice, Eng.	All islands	Straw	Hats, etc.
Pandanus dubius Spr. (Pandanaceæ). Barew or Bariw, B., V.	Luzon and the Visayan Islands.	Leaves	Hats, mats, baskets, pocket cases, bags, sails, etc.
Pandanus sabotan Blanco (Pandanaceæ). Sabotan, T.	Laguna	do	Mats called "sinabotan" or "sinabatan" and boxes called "tampipi."
Pandanus spiralis Blanco (Pandanaceæ). Pandan, T.; Screw Pine, Eng.	Luzon and other islands.	do	Mats, large hats, etc.
Pandanus sp.? (Pandanaceæ). Caragamay, Caragomoy, Caragumay, Curagomoy, C.; Karagomoy, B.	Luzon and the Visayan Islands.	do	Hats, mats, etc.
Parameria sp. (Apocynaceæ) Bulaobulao, V.	Antique, Negros Occidental.		Tying purposes.
Pennisetum sp. (Gramineæ) Aguingay, V.	Bohol	Stem	Hats, etc.
Phaleria sp. (Gramineæ) Salagod, V.	Camarines, Negros Occidental.		Cordage.
Procris erecta Blanco (Urticaceæ). Hanopol, Janopol, T.	Tayabas		

A list of Philippine fiber plants—Continued.

Scientific and local or native names.	Distribution.	Part used.	Uses, etc.
Pterocarpus blancoi Merrill (Leguminosæ). Aplit, P.	Pampanga	Bark	Rope.
Pterospermum diversifolium Blume (Sterculiaceæ). Baroy, Il.; Bayog, V.	Luzon and other islands.	Inner bark	
Saccharum spontaneum L. (Gramineæ). Cogon, T.	All islands	Stem and leaves.	Hats, thatch.
Sesbania aegyptiaca Pers. (Leguminosæ). Malucadios, V.	Masbate		
Sida carpinifolia Linn. (Malvaceæ). Silhigon, V.	Visayan Islands	Leaves	Ropes, twine, etc.
Sida frutescens DC. (Malvaceæ). Lalauisin, T.; Taclingvaca, Pn.; Tacquimvaca, Il.; Waliswalisin, P., T.	Luzon Islands	Bark	Cloths, twine, etc.
Sida indica Blanco. (Malvaceæ). Dalupang, V.	Negros Occidental		
Smilax indica Linn. (Liliaceæ.) Kamagsa, T.	Laguna		
Smilax latifolia Blanco (Liliaceæ). Sipit-ulang, T.	Nueva Ecija	Stems	Ropes.
Sterculia foetida Linn. (Sterculiaceæ). Bangar, Il.; Calumpang, P., T.	Luzon and other islands.	Inner bark	Do.
Sterculia urens Roxb. (Sterculiaceæ). Banilad, Canilad, V.	Visayan Islands	do	Twine.
Thespesia camphylosiphon Rolfe (Malvaceæ). Lanutan, V.	Romblon		Hats, rain coats.
Thespesia populnea Corr. (Malvaceæ). Bubuy, B., T., V., Il.; Bulacan, V.; Tree Cotton, Eng.	Luzon and the Visayan Islands.	Lint on seed	Pillows, mattresses, cloths, paper, etc.
Typha angustifolia Linn. (Typhaceæ). Balangot, T., V.	Luzon and other islands.	Leaves	Twine, hats, etc.
Urena multifida Linn. (Malvaceæ). Colotan, Colot-colotan, Culut-culutan, Molopolo, Dalupan, T., P.	Luzon	Bark	Ropes; strong fiber.
Zizyphus jujuba Linn. (Rhanmaceæ). Manzanitas, Sp., T , Il.	do	do	

A SUPPLEMENTARY LIST OF UNCLASSIFIED PHILIPPINE FIBER PLANTS.

[Alphabetically arranged by their native names by F. Lamson-Scribner, Chief of Insular Bureau of Agriculture.]

Native names.	Distribution.	Part used.	Uses, etc.
Abagon, P	Tarlac		Ropes.
Aga, T	Luzon	Inner bark	Ropes, roofing; apron or breech cloths and sheets of Ibilaos and Negritos; fiber obtained by maceration.
Agpui, P	Pampanga	do	Strings for bows.
Ampopoyat, Il	Abra		A vine.
Anito, P	Pampanga		Ropes
Aramay, Il	Nueva Vizcaya	Bark	Twine cords etc.
Arandong C	Cagayan	do	Textile from the tree called 'baliti.'
Arivat, Il	Abra		A vine.
Babaian, P	Pampanga	Outer part of stem	Used for wearing apparel.

A supplementary list of unclassified Philippine fiber plants—Continued.

Native names.	Distribution.	Part used.	Uses, etc.
Babaquet, Il	Abra		A vine.
Bagaas or Baga-as, V	Negros, Panay	Stalks	Hats, mats.
Bagocon, V., B	Visayan Islands	Inner bark	Ropes, twine.
Bagucon, V., B	....do	....do	Do.
Baito, T., Z	Bataan, Zambales		Hats, " salacots."
Balading, V	Masbate	Leaves, roots	Hats, mats, ropes.
Balanac, T	Nueva Ecija		Strings, etc.; fiber is as strong as piña.
Balbal-liga, Il	Abra		A vine.
Balbas, P	Tarlac		Do.
Balen or Balio, V	Visayan Islands	Leaves	Hats, mats, etc.
Balew, V	Bohol	....do	Mats.
Balicnong, V	Antique	Bark	
Baliu, V	Visayan Islands	Leaves	Hats, mats, etc.
Baliwag, T	Bulacan	Stems	Hats; variety of bamboo.
Ballo, V	Negros Occidental	Leaves	Hats, mats.
Balnot, B	Camarines	Inner bark	Ropes; twining plant.
Baloc-Baloc, V	Mindora		
Balunos, V	Capiz	Stems	Ropes; a vine.
Banacalao, Pn	Pangasinan		Cigar cases.
Bannacalao, Il	Ilocos		Do.
Banitlong, V	Negros Occidental		Ropes.
Baquit, V	Iloilo		Hats.
Barinas, P., T	Tarlac		Ropes, cord.
Barinatnat, Il	Abra		A vine.
Barong, P., T	Tarlac		Ropes, cord.
Batarag, Il., C	Northern Luzon	Stems	Whips, tying bales of tobacco.
Batian, P	Pampanga		Ropes; a vine.
Bical, Il., Pn	Northern Luzon	Stalks	Large hats.
Bicul, Pn	....do	....do	Do.
Biling, V	Bohol	Bark	Hats, mats.
Bilua, T	Nueva Ecija		Ropes.
Bolongkahinay, V	Occidental Negros	Stems	Cordage; a vine.
Bongbong, V	Bohol	Cortex	Sieves, etc.
Bonot-Bonot, V	Masbate	Bark	Cords.
Bubuyan, P	Pampanga	Palm	Twining.
Bugang, V	Bohol	Bark	Mats, hats.
Bugayon, Il	Abra		A vine.
Bulut Bulutan, P	Pampanga		Ropes.
Cacauon, B	Albay	Inner bark	Do.
Calal-laquiti babalaquet, Il.	Abra		A vine.
Calasias, T	Bataan	Stems	Do.
Camacsá or Camagsá, B., T.	Southern Luzon	....do	Fish corrals, lashing timbers, etc.
Camangey, Il	Abra	....do	A vine.
Camoras, V	Bohol, Iloilo	Leaves	Hats.
Campapalis, P	Pampanga		Ropes; yields a very fine fiber.
Cana or Cava, T	Cavite	Bark	Ropes, strings.
Canato			Lashing.
Canayan, V	Iloilo	Inner bark	Hats.
Candaba, V	Masbate	Leaves	Shirts.
Capas ñga Vayan, Pn	Pangasinan		Species of cotton.
Carome, Pn	....do		Large hats.
Carumsi, Il	Ilocos Norte	Stems	Hats, baskets, etc.; a vine
Catalina, T	Bulacan	Bark	
Ciapo, V	Oriental Negros		Cloths and ropes.
Cilag, Il	Northern Luzon	Leaves and stems	Mats and hats.
Curipat-tong ti nuang, Il	Abra	Stems	A vine.
Dao, V	Antique	Bark	
Dolocot, V	Iloilo	Stalks	Hats.
Donlareng, Pn	Pangasinan		Cigar cases.
Gubid			Fish corrals.
Guiliman, P	Pampanga	Stems	Ropes, fish nets, and weirs. A vine.
Guilon, V	Bohol		Hats and mats.
Guiote, Pn	Pangasinan		Species of cotton.
Guni, P	Tarlac	Stems	Ropes; a vine.
Gueodeng, Z	Zambales	Bark	Ropes
Hanadiong or Ilandong, T.	Batangas	....do	Ropes, fiber obtained by maceration.
Hanagdong, V	Occidental Negros	Inner bark	Twine.
Inillo, V	Antique		Species of cotton; said to be more durable than "bulac."
Jabo?, Z	Zambales	Bark	Ropes; fiber compares favorably with Manila hemp.
Jambabalod, V	Antique	....do	
Jory, Pn	Pangasinan	Stems	Binding and lashing; a vine.
Jayud-Bayad, V	Masbate		Hats, mats.
Jinagdong, V	Visayan Islands		Cords, ropes.
Junay, V	Samar		Species of bamboo; very useful.
Kahpok, M	Cottabato	Lint on seed	Wild cotton.
Kauat-Kadlagan, B	Southern Luzon		Cords, ropes.

A supplementary list of unclassified Philippine fiber plants—Continued.

Native names.	Distribution.	Part used.	Uses, etc.
Labayo, T	Batangas		Ropes.
Labog-Labog, V	Visayan Islands	Bark	Twine; fiber resembles jute.
Lalabang, Il	Nueva Viscaya		Hats, rain coats.
Lang-an, V	Antique	Bark	
Lañgiñgi			Cordage.
Langlangsi, Il	Abra	Stem	
Langosig, V	Bohol	Bark	Twine.
Langusig, V	Occidental Negros		Cloths and ropes.
Ligno, B	Albay		Hats, mats.
Lingis, Il	Ilocos Norte	Leaves	Mats; a kind of palm.
Lingi, Z	Zambales		Fine fabrics and cordage; resembles silk.
Lipay, Il	Abra		A vine.
Locmoy or Logmoy, T., V.	Laguna, Mindoro		Binding purposes and basket work.
Lonoc			Cordage.
Lumbay, V	Romblon	Inner bark	Ropes, etc.
Lumpa, V	Antique	Bark	
Lupig, T	Bulacan	do	
Lusuban, Il	Abra	do?	
Maalaases, T	Batangas		Ropes.
Mag-nag, Pn	Pangasinan		A species of cotton.
Mala Achuete or Mala Achiote, T.	Luzon		Cordage and ropes.
Malacadios, V	Masbate	Inner bark	Twine.
Malapan, P	Pampanga		Ropes.
Malapao, T	Nueva Ecija	Bark	Cordage.
Malasap, T	Bulacan		Do.
Malasapsap, T	Central Luzon		Ropes.
Malasiag, T	Laguna	Bark	Do.
Malidlong, V	Oriental Negros	do	Blankets, etc.; a tree called "jalubang."
Malubitis, P	Pampanga		Ropes; yields a fine white fiber.
Malvavisco, T	Batangas		Ropes.
Maragayaman, Il	Union	Stems	Tying purposes.
Maratarong, Il., Pn., T	Central Luzon		Cordage.
Marataca, Il	Union	Inner bark	Tying purposes.
Marotarong, Pn	Pangasinan		Pouches.
Mayambago, M	Surigao	Inner bark	
Metu, P	Pampanga	Stems	Ropes; a vine.
Mulios or Muliot, T	Batangas		Ropes.
Nabo, V	Oriental Negros	Bark	
Nagsangsanga, Il	Abra		A vine.
Ngintu, C	Cagayan		Weaving purposes; a vine.
Oag-oag, Il	Union		Hats.
Oay ni panglao, Il	Abra		A vine.
Ongali, M	Surigao		Tying purposes.
Oplig, Il	Abra		A vine.
Oyagno, B., V	Southern Luzon	Leaves	Hats, mats, baskets, pocket cases, etc.
Paat-haló, V	Occidental Negros	Inner bark	Twine.
Pacacbaquir, Il	Abra	do	Ropes; a tree.
Pacnot, V	Romblon		Ropes; cords.
Pangihan, T., V	Luzon, Bohol, etc	Bark	Ropes; a large tree.
Patangis, V	Masbate	Inner bark	Ropes; a tree.
Poeteg, Pn	Pangasinan	Lint on seed	Cotton.
Popoyoten, Il	Abra		A vine.
Pusapusa, P	Tarlac		Do.
Quedding, Il., P., T	Abra, Tarlac	Inner bark	Cordage.
Quillo, V	Antique	Lint from seed	Cloths, etc.
Quinio Negro, Z	Zambales	Stems	Fish corrals; a vine.
Rabo de Leon, Il., Pn	Ilocos Norte, Pangasinan.	Leaves	Cloth; fiber resembles Manila hemp.
Rangrangen, Il	Abra		A vine.
Roroy, B	Albay	Leaves	Inferior hats, mats.
Sabid Lucong, Il	Abra	Vine	
Sabnit, T	Batangas		Thread.
Sadáo, Il	Abra	Vine	
Sadiac a juirao, Il	do	do	
Saguiat, V	Oriental Negros	Bark	Ropes and cloths.
Sanseviera, V	Occidental Negros		Textiles and cordage.
Saracay, Il	Ilocos Norte	Leaves	Hats.
Sayapo, V	Oriental Negros		Ropes and cloths.
Siapo, V	Visayan Islands	Inner bark	Ropes.
Siliman, P	Tarlac	Vine	
Sima?, P	do	do	
Sinaligan, Pn	Pangasinan		Cigar cases.
Singitan, Il	Ilocos Sur	Inner bark	Cords, twine, etc.
Sinitu, C	Cagayan		It is braided over a strand of bejuco and used for holding skirts.
Sumaringat, Il	Abra	Inner bark	Ropes, twine.
Tabong, V	Capiz		Ropes.

A supplementary list of unclassified Philippine fiber plants—Continued.

Native names.	Distribution.	Part used.	Uses, etc.
Talibagbangan			Cordage.
Talota, V	Antique	Bark	
Taluto, T	Batangas		Do.
Tamuguí			Cordage.
Tapitac, P	Pampanga		Do.
Tawtawon, V	Samar	Bark	
Tayom, V	Capiz		Hats.
Tayuctayuc, V	Visayan Islands	Leaves	Hats, mats, etc.
Ticog, M., V	Luzon, Mindanao, etc.		Mats, pocket cases, etc.
Udin, Il	Nueva Vizcaya		Salacots, ropes.
Ungale			Cordage.
Variw, V	Antique		Pocket cases, hats, mats.
Wakal, Pn	Pangasinan	Stems	Fishing lines; a vine.

Native names of fiber plants reported to the Bureau of Agriculture by correspondents without further information.

Agnasag, V.
Aguingay.
Alagong, T.
Alibambang, T.
Amagon, T.
Amuyong, T.
Balafahu, Il.
Balangauan, V.
Balin, V.
Bannoang, Il.
Baris-an, Il.
Basay, V.
Baud, M.
Bilibid, V.
Bitnong, T.
Bonol, V.
Bubug, C.
Bulalat.
Bunang-Bunang, V.
Bunutan, Il.
Butnong, Il.
Cacaoag, Il.
Cagay, V.
Calios, T.
Camagon, T.
Camcamoras, Il.
China Cotton, Il.
Cuhi, P.
Culacling, T.
Cuni.
Dalag or Dal-lag, Il.
Daldal-Lopang, Il.
Dapig, Il.
Daromacá.
Gapas-Gapas, V.
Guinabang, T.
Hambabago, V.
Himbabao, T.
Hinaqui, V.
Humay Maya, V.
Impid.
Ingual, Pn.
Isis, T.
Labing.
Lanutan, T.
Lipa, T.
Longtot, Il.
Lubirin, T.
Lucay, V.
Mabago, V.
Malabulac, T.
Muda Ticog, V.
Oclig, Il.
Pana or Bugang.
Pangalunachien, Il.
Paoá, V.
Putat, T.
Quegded, T.
Quernes, T.
Ragnivdin.
Sabay-Sabay, V.
Sabutan.
Sagacap, V.
Salogon, V.
Sugarap, V.
Supig, T.
Tagacarao or Taotaohan, V.
Tigbao, V.
Tulongbalite, T.
Tungu, T.
Tutag, Il.

BUREAU OF AGRICULTURE.

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MAGUEY IN THE PHILIPPINES.

By H. T. EDWARDS, 1904.

LETTER OF TRANSMITTAL.

SIR: I have the honor to transmit herewith, and to recommend for publication as a farmers' bulletin, the manuscript of a paper entitled "Maguey in the Philippines."

There is reason to believe that the production of maguey can be made one of the important agricultural industries of the islands. The maguey plant is already widely distributed, having been reported to this bureau from 22 different provinces. There are large areas of land, unsuited to almost any other crop, which would be in every way satisfactory for maguey. There is a good demand for the fiber, the current quotations for sisal in the New York markets being but 2 cents less per pound than for abacá. For the development of this industry in the Philippine Islands, it is deemed important that every effort should be made to improve the conditions of plantation management, to encourage the introduction of fiber-extracting machinery, and to disseminate as widely as possible whatever information is available relative both to the cultivation of the plant and to the extraction and treatment of the fiber.

Very respectfully,

H. T. EDWARDS, *Fiber Expert.*

Prof. F. LAMSON-SCRIBNER,
Chief, Bureau of Agriculture.

INTRODUCTION.

Maguey and sisal are the common names of two closely allied species of the genus *Agave.* There has been some confusion in the use of the name maguey, it being sometimes applied to all of the species of agave. Strictly speaking, however, the maguey of Mexico and Central America is the *plant* of *Agave americana* which produces the fiber known as "pita," while sisal is the *fiber* produced by the plant henequin, *Agave rigida sisalana.* In the Philippine Islands both the plant and the fiber are generally known as maguey and have been classified as belonging to *Agave americana.* It is probable, however, that the greater part of the so-called maguey fiber of the Philippines is produced by the species *Agave rigida sisalana* and should, therefore, more properly be termed "sisal." The fiber known as ixtle, or Tampico fiber, is produced by *Agave heteracantha.*

The agaves are natives of Central America, but are now widely distributed throughout the world. They are found in Mexico, Central America, the West Indies, southern Europe, India, and other countries. The plants are often used for ornamental purposes, the juice has medicinal properties and when distilled has a wide use as an intoxicating beverage known as pulque or mescal, the pith furnishes a good substitute for soap, and the fibers have a great variety of uses, viz, for cordage, fishing lines, nets, hammocks, saddle blankets, brushes, laces, and both fine and coarse fabrics.

HISTORY AND DISTRIBUTION IN THE PHILIPPINE ISLANDS.

Maguey was first introduced into the Philippine Islands from Mexico or Central America by the Spaniards, but at what time, or by whom, we are unable to determine. The plant has long been raised in these islands, but it is only in very recent years, since there has been an increased demand for the fiber, that its cultivation has become an important industry. From the provinces of Ilocos Norte, Ilocos Sur, and Union maguey fiber is now exported in considerable quantities. In many other provinces we find the maguey plant and in numerous instances the fiber is extracted for local use.

The production of abaca has been such an important industry in the islands and its cultivation has received so much attention, that the good qualities and true value of maguey have been to some extent overlooked.

In the different provinces we note a variation in the spelling of the word "maguey," also several distinct ways of extracting the fiber and a number of different uses for the same. Although this fiber is produced in commercial quantities in but a few provinces the maguey plant is widely distributed throughout the islands. The cultivation and utilization of maguey have been reported to this bureau from 22 different provinces, as follows: Abra, Albay, Antique, Bataan, Batangas, Benguet, Bohol, Bulacan, Camarines, Capiz, Ilocos Norte, Ilocos Sur, Iloilo, Masbate, Nueva Ecija, Nueva Vizcaya, Pampanga, Pangasinan, Romblon, Tayabas, Union, and Zambales. In different localities the fiber is separated by different methods and is used for different purposes, as is shown by the following data.

Abra.—Maguey grows abundantly in the Province of Abra but is not largely utilized owing to the difficulty of separating the fiber without the use of sea water for retting. Experiments have been made in sending the maguey leaves from this province to the tide waters of Ilocos Sur. The fiber thus produced was in all respects equal to that obtained from the plants grown in Ilocos. Maguey also has a local use peculiar to this province. The leaves are split lengthwise into a number of parts. These parts are dried in the sun for two or three hours and are then used as lashings for tying bales of tobacco. This material, however, is reported to be lacking in strength and not of great value.

Albay (*magui and maguei*).—Grown in small quantities for local use only.

Antique (*magui*).—In Antique maguey fiber is extracted by the same process as that used for piña (pineapple). The leaf is placed on a smooth board and is scraped with a piece of earthenware which removes the pulp. The fibers are then taken out by hand, washed, and dried. This method produces a very fine quality of fiber which is used in the manufacture of delicate fabrics.

Bataan.—Grown in small quantities for local use only.

Batangas.—Several thousand plants have recently been sent to Batangas from Ilocos Sur. Maguey had previously been grown in this province only in small quantities. Two methods of fiber extraction are practiced in Batangas: (1) The leaf is treated by the stripping process employed for abacá; (2) the leaf is split into two parts, one end being fastened to a stick or pole. The free end is then caught between a piece of split bamboo, which is manipulated with both hands of the operator over the entire length of the leaf until the pulp is entirely removed. Both of these methods are more laborious than the retting process, but they produce a better quality of fiber.

Benguet.—Maguey is grown in the pueblo of Kapangan, Benguet Province. It has only a local use.

Bohol (*magay*).—Found principally in the pueblos of Loon, Panglao, and Maribojoc. The fiber has a local use both for cordage and for fabrics.

Bulacan (*mague*).—Grown only in small quantities for local use.

Camarines.—Grown largely in the pueblo of Basao. The fiber is separated by the piña process and is used in making fine and delicate fabrics. There is a great deal of land in Camarines well suited to maguey, and its cultivation might well become an important industry.

Capiz.—Grown in small quantities for local use.

Ilocos Norte.—Ilocos Sur and Ilocos Norte are the two important maguey-producing provinces of the islands. Nearly all of the fiber which is exported comes from these two provinces. Maguey is found in all parts of Ilocos. In the pueblo of Batac it is estimated that one-fourth of the population (18,000) is engaged in raising maguey. In Paoay it is estimated that there are 300 hectares of maguey, producing an annual output of fiber valued at $7,500. There are several important plantations in the pueblo of Nagpartian and in the barrio of Davila. Owing to the method of planting maguey in small and widely scattered plots, it is difficult to make any very definite estimate of the area under cultivation. The only estimate received by this bureau states that in this province 500 to 600 hectares are under cultivation, producing an annual yield of about 2,500 piculs of fiber. It is the general custom on the different plantations to use the rich lowlands for rice and corn, reserving for maguey sandy knolls, fence corners, and any other so-called "waste land," it being considered that the only requirement for maguey is sufficient room in which to grow. There has been a great increase in the area devoted to maguey during the past few years, owing to the higher prices paid for the fiber. Maguey fiber is used locally in Ilocos Norte, both for cordage and for fabrics, and is exported in large quantities.

Ilocos Sur.—This province produces by far the largest amount of maguey fiber of any province in the islands. The general conditions are all the same as in Ilocos Norte. Planting is largely done on waste lands; the fiber is extracted by the retting process, and is exported to Manila.

Iloilo (*magui*).—Grown in small quantities near the seacoast. Has only a local use.

Masbate (*magui*).—Grown in small quantities. The fiber is extracted by the piña method, and has only a local use.

Nueva Ecija, Nueva Viscaya, and Pampanga.—Grown in small quantities for local use.

Pangasinan (*amaguey* or *pita*).—A small amount of fiber is exported from this province, and it has a limited local use for cordage and for fabrics.

Romblon (*pita*).—Grows near the seacoast in small quantities.

Tayabas.—Grown in small quantities and used for fabrics. Is considered equal to piña.

Union.—Is exported in small quantities and has a considerable local use, principally for cordage. The fiber is extracted by the water-retting process.

Zambales (*amaguey*).—Conditions are similar to those of Union. Small quantities of the fiber are exported and water-retting is practiced.

The above data is sufficient to show that while maguey is not, at the present time, an important crop in many provinces, it is, nevertheless, widely known and distributed. This fact will greatly facilitate its more general introduction.

THE MAGUEY PLANT AND FIBER.

The maguey, or "century plant," is largely used in the United States for ornamental purposes. In many parts of the Philippine Islands it may be seen growing by the roadside, in gardens, and in neglected fence corners.

The plant consists of a short heavy stem, which bears an aloe-like cluster, or rosette, of from 20 to 40 thick fleshy leaves. These leaves are from 3 to 7 feet long, and from 2 to 4 inches wide. They are light green in color, are covered with a whitish powdery substance, bear sharp lateral teeth, and a terminal spine. The leaf is composed of pulpy material, interspersed with vascular bundles which furnish the fiber. When the plant matures, which is in from seven to fifteen years, a central stalk, or "pole," grows to a height of from 15 to 20 feet. This stalk first bears flowers and afterwards a large number of small bulbs, which, when mature, fall to the ground. After flowering once the plant dies.

The fiber of the maguey, belonging to the class known as structural fibers, is produced by the leaves. It is obtained by separating the pulpy portion of the leaf from the fine filaments or fibro-vascular bundles, which run through this pulp. The fiber, if carefully separated and dried, is quite white and brilliant. It is 4 to 5 feet long, is fine and soft, and is more wavy or fluffy than Manila hemp. Another marked quality is its elasticity, which gives it great value when used for cordage that is liable to be subjected to any sudden strain. "Its main faults are the stiffness, shortness, and thinness of wall of the individual fibers, and a liability to rot."[a]

Its strength, as compared with certain other fibers, is shown by the following data: "In a trial of strength, near Calcutta, the tests were made with ropes 1 fathom long and 3 inches in circumference, with the following results: The agave or pita broke in a strain of 2,519½ pounds; coir, 2,175 pounds; jute, 2,456½ pounds; and sunn hemp, 2,269½ pounds. In an experiment with Russian hemp and pita, the first-named broke with 160 pounds weight, and the latter with 270 pounds."[b] These tests are sufficient to show that in the important quality of strength maguey compares favorably with other well-known commercial fibers.

CLIMATE.

Almost any tropical or subtropical climate appears to be favorable for the growth of maguey. Owing to its thick, fleshy leaves it will not suffer during a prolonged drought, while it also flourishes in the humid climate and during the rainy season of the Philippines. It is stated that in a humid climate a longer and more elastic fiber is obtained. The only injury which the plant suffers in the Philippine Islands, from climatic conditions, is from the heavy winds, which sometimes tear and lacerate the leaves.

SOIL.

The most important feature of a soil suitable for maguey is that it shall be well drained. The plant is very sensitive to water at the roots and without good drainage will make but a poor growth or will die outright. Maguey will grow well either on a heavy or a light soil and under very adverse conditions, but the impression that it will do well in any soil is a mistaken one. Plantings are sometimes made close to the seashore in dry sand. Under these conditions even this hardy plant can not be expected to thrive. Undulating land or hilly slopes are the most suitable locations, as in such places there is usually excellent drainage. On the plantations in the Ilocos Provinces, the lowlands are used for rice and corn, the small hills, together with any sandy or stony pieces of ground, being reserved for maguey. The planters in these provinces will always state that "Only cheap land should be devoted to maguey." While this may be true with the present slow and expensive method of fiber extraction, with the introduction of fiber-extracting machinery it is very probable that much of the land now used for other crops, which are considered of greater value, might well be planted to maguey. This plant will grow and yield a certain amount of fiber upon almost any soil and with no care; under more favorable conditions, however, the yield of fiber may be greatly increased.

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[a] Spon.

[b] Dodge.

ESTABLISHING A PLANTATION.

The practical question which faces any prospective planter of maguey is, "Where, and under what conditions, can a maguey plantation be established in the Philippine Islands?" Suitable climatic and soil conditions can be found in almost any province in the islands. If the fiber is to be extracted by water-retting, the location must be near the mouth of some river where the tide water can be utilized. This method can not be recommended. It is slow and expensive, and requires the use of a great amount of labor. If fiber-extracting machines are to be used, the location can be made at any point where there is a sufficient amount of well-drained land, heavy clays and very light sands being avoided if possible. Due consideration should also be given to the facilities for transportation, the amount of available labor, and a good water supply at some central point.

The general methods of plantation management, as described in the bulletin entitled "The cultivation of sisal in Hawaii," may be advantageously followed in these islands. Owing to the difficulties and slowness of transportation, the first step to take, after having secured the land for the plantation, should be to order the suckers for planting. These can usually be bought in sufficient quantities from the maguey planters either of Ilocos Norte or Ilocos Sur, and cost from $3 to $6, local currency, per 1,000. The plantation should then be mapped out, the land cleared, and the sites selected for buildings and a nursery.

PLANTING.

The maguey produces both seed and suckers, the former, however, only in small quantities. In starting a new plantation, seed is seldom or never used. When the maguey plant reaches maturity, suckers grow out from the axils of the lower leaves and small bulbs are borne upon the flower stalk or "pole." Either these suckers or the bulbs may be used for the new plantation. If it is possible to secure well-developed suckers, these may be planted at once in the field. When bulbs or pole plants are used, they should be first set in the nursery in rows 1 foot apart and 6 inches in the row. In about a year these nursery plants will be ready for transplanting.

The system of planting followed in the Philippines differs materially from that of Mexico and Hawaii. In the latter countries the plants are set from 6 to 8 feet apart, while in these islands they are usually given but 3 or 4 feet. The reason for this close planting is said to be that if given a greater distance the plants will be torn and lacerated during the heavy "baguios" or windstorms. This matter is one to be largely determined by local conditions, the nature of the soil, the climate, and the frequency of heavy winds. In a locality subject to typhoons, close planting may be necessary; otherwise the number of plants should not exceed 800 to 1,000 to the acre. The time for planting is during the rainy season, from June to November.

CULTIVATION.

In the nursery the plants should be kept well cultivated. In the field no cultivation is necessary except to keep down the grass and weeds. Owing to the sharp teeth and spines which are borne on the leaves, the use of animals for cultivating soon becomes impossible. When the plants are fully developed, even hand cultivation becomes impracticable. Great care should be taken when doing any cultivating not to injure the leaves, as such injury will lower the quality of the fiber.

INSECTS AND DISEASES.

The hardiness of the maguey plant with regard to soil and climatic conditions seems to be equally true as regards insect enemies and fungous diseases. The sisal of the Bahamas was at one time attacked by fungus on the leaves, and a mealy bug has been reported as having done some damage. In these islands, however, the plant does not appear to be troubled either by insects or diseases. It is stated that the only enemy of the maguey, in the Philippine Islands, is the typhoon.

EXTRACTION OF FIBER.

The first crop of leaves can be cut in about three years from the time of planting. It is customary to harvest once a year during the dry season, from January to May. Each plant should then bear from 15 to 20 leaves. The fiber-extraction process should commence within twenty-four hours after cutting, as otherwise the fiber will be stained at the end. There are several different methods used in the Philippine Islands for the extraction of the fiber.

1. The abacá stripping process.
2. The split-bamboo stripping process.
3. The piña scraping process.
4. The maceration and retting process.

The methods of extracting, by which the fiber is separated from the pulp without the use of water for retting, give a product of very superior quality. These methods, however, are slow and laborious and are not in any general use.

The retting process has for its object the dissolution of the gummy, resinous substance which envelops the filaments. This substance, being very adhesive, prevents the free separation of the fibers. If the leaf is not sufficiently retted, the fibers will still adhere to each other; if the process is carried too far, the product is seriously injured or rendered utterly worthless.

Two distinct methods of retting are in use. In the former the leaves are cut, crushed, or beaten, gathered in bundles, and allowed to ferment. When fermentation has ceased, the bundles are placed in water until the pulpy material has further deteriorated. If this process is properly carried out, the leaves may be removed from the water after two days of retting. By this process one-third or more of the product is converted into tow. By the latter method after the leaves are cut and the thorns removed, they are split into four or five pieces and made into bundles, these bundles being immediately placed in water for retting. It is advisable to have the bundles small and of uniform size. The coarser leaves should be separated from the more tender ones; as the latter ferment more quickly.

A great deal depends upon the nature of the water used for retting. This may be stagnant or running, fresh or salt, warm or cool. A high temperature and saline properties increase the rapidity of the process. Stagnant water has the advantage of being warmer and the disadvantage of easily becoming foul. Salt water is preferable to fresh. The tide waters of the rivers are most generally used.

For the retting process the bundles of leaves are placed one upon another in the water. They should be turned every three or four days, as those on the bottom will ferment more rapidly. Even when the greatest care is used, by the time the coarser part of the leaf is ready to be removed the finer part is overretted and more or less weakened. This difficulty may be overcome by setting upright sticks in the water, fastening the bundles to them, and first retting for three or four days only the coarse part of the leaf. This method is more expensive, but will produce a better product. After the seventh day the leaves should be inspected daily. They may be removed in from seven to fourteen days, depending upon the condition of the water.

AFTER-TREATMENT OF FIBER.

When the retting process is complete, the fiber should be removed from the water and dried in the sun. This drying will ordinarily take from two to three days. Care should be taken that the fiber be not exposed to rain or heavy dews during the process of drying, as these elements will injure its appearance and quality. After being thoroughly dried, a shaking and brushing is necessary in order to remove whatever extraneous matter may still adhere to the fiber. The finished product is now ready for the baling press. During whatever handling is necessary, and in the process of baling, great care should be taken that the fiber be kept perfectly dry and that the different strands and hanks do not become tangled or dirty.

YIELD.

Owing to the fact that this bureau has not, as yet, done any experimental work with maguey, the only available figures as to the yield of fiber per leaf, per plant, and per acre are those furnished by our correspondence. Unfortunately, these figures show a remarkable variation, so that only a general estimate can be made. In Ilocos Sur the yield of fiber is estimated at 1 picul of 137½ pounds for every 6,000 leaves. Plantings made 4 by 4 feet would give, approximately, 2,700 plants to the acre. With an average yield of 15 leaves to the plant we would have a total yearly yield of 40,500 leaves, producing 6¾ piculs or 928 pounds of fiber per acre. The estimated yield of the fiber in this province is 4 per cent of the weight of the leaves. This is the same as the sisal of Yucatan and somewhat higher than that of Hawaii. The total amount of maguey fiber exported from the Philippine Islands for the year 1901 was 875 tons. For the first six months of the year 1902, 867 tons were exported, indicating a considerable increase in the annual production.

VALUE AND USES OF FIBER.

The current prices paid by commercial houses in Manila for maguey fiber are as follows: For the first grade, $15, local currency, per picul; for the second grade, $12 per picul; for the third grade, $9 per picul. It is stated by fiber growers that the average relative amount of the different grades obtained from a given amount of fiber is for 1,000 pounds of fiber: First grade, 920 pounds; second grade, 50 pounds; third grade, 30 pounds.

The fiber is produced both for local use and for export. In the Visayas, maguey is extracted by the same method as that used for piña. By this process a very fine and soft fiber is secured, which is suitable for use in making delicate handkerchiefs, laces, and cloth. When used for these purposes, the young and tender leaves should be selected, as these yield a finer quality of fiber. In northern Luzon, where extraction is by water-retting, the fiber is coarser and is more suitable for cordage.

Maguey fiber has a variety of uses in nearly all civilized countries of the world. In the United States it is used principally for binder twine, also for ships' ropes and cables, and for small cordage; in Mexico and South America for lines, nets, hammocks, and saddlecloths; in European countries for various classes of cordage.

FIBER-EXTRACTING MACHINERY.

The essential principle of the fiber-extracting machine is that the pulpy material of the leaf is scraped from the fiber without any preliminary maceration or fermentation, thus saving all of the expense and labor of the slow retting process. The use of fiber-extracting machines is a question which has received much attention and is a matter of general interest in the Philippine Islands. In the case of abaca no machine has yet been introduced which has met with any considerable degree of success. With maguey, however, several different machines are in general use in Mexico and the West Indies. Descriptions of the simple "raspador" and of the machine used at Sisal are given in the bulletin entitled "The cultivation of sisal in Hawaii." There is no reason why such machinery should not be used in the Philippine Islands. The quantity of fiber produced is amply sufficient to justify its introduction. With suitable climatic and soil conditions, it only requires machinery to make the production of maguey an important industry in these islands. Without such machinery, however, this industry can never become a very profitable one. The competition between different fibers is now such that only those possessing the most desirable qualities and which are produced at a minimum cost can be expected to hold their place in the commercial world.

PROSPECTS OF THE MAGUEY INDUSTRY IN THE PHILIPPINE ISLANDS.

The general aspects of the maguey industry, as it now exists in the Philippine Islands, have already been considered. The plant is widely distributed through the islands. The fiber is extracted in a small way in many provinces and in considerable quantities in northern Luzon.

Maguey fiber has a recognized place as one of the leading commercial fibers of the world. Its production on a large scale is a profitable industry in Mexico and Central America, where the conditions are in no way more favorable than they are here in the Philippines. With the same businesslike management of plantations and the use of fiber-extracting machinery the industry is one which should yield reasonable profits and which is worthy of being widely extended in these islands. The maguey plantation, either in this or in any other country, can never be looked upon as the proverbial "gold mine." It is, however, a safe and profitable industry, and where abaca will die for want of water and cotton is destroyed by insect enemies maguey continues to flourish and yield good returns.

BUREAU OF AGRICULTURE.

(Farmers' Bulletin No. 11.)

THE JUTE INDUSTRY, CONSIDERED IN RELATION TO ITS INTRODUCTION INTO THE PHILIPPINES.

By William S. Lyon, 1904.

LETTER OF TRANSMITTAL.

Department of the Interior,
Bureau of Agriculture,
Manila, P. I., October 1, 1904.

Sir: At least three species of the jute plant are recorded as occurring spontaneously in the Philippines, but outside of limited experimental plantings made by this bureau its culture for commercial purposes has never been undertaken.

Believing that the physical conditions over much of the Philippines meet the cultural requirements of this plant, and that the manipulation of its product is one that will peculiarly commend itself to the native farmer, I have prepared the following synopsis of the industry as practiced in India, and explained the benefits that would inure from the cultivation of the better Indian varieties in these islands.

Very respectfully,

Wm. S. Lyon,
In charge Division of Plant Industry.

The Chief of the Bureau of Agriculture,
Manila.

INDUSTRIAL SIGNIFICANCE.

The large commercial cultivation of "jute," "gunny," or "Calcutta flax," as it is variously known to the textile fiber trade, is practically restricted to British India, and is there second only to rice, the most important single agricultural product of the British Indian Empire.[a]

Its cultivation is sparingly carried on in China, Japan, and Tonquin, and has been attempted in the southern United States, but in this latter country up to this time with a larger measure of failure than success.

Cotton excepted, jute, quantity and value of the raw product considered, is the most important vegetable fiber known. The estimated annual product of British India alone is more than 15,000,000 metric quintals. The annual value of its exports of raw fiber have amounted in recent years to £10,575,477 sterling. In addition to this Calcutta exports annually more than 100,000,000 sacks, which does not include the vast number consumed locally. The export value of these sacks is not given, but it is probably not less than £1,400,000, or enough to swell the total of the industry to about £12,000,000 sterling, or about threefold the value of the great Philippine hemp industry.[b]

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[a] Many of the statistics in this paper are drawn from a memoir upon this topic from the capable pen of M. E. de Wildeman and published in the Bulletin of the Société d'Etudes Coloniales for October, 1903.

[b] The figures here given are probably a low estimate. According to the Textile World (January, 1904) the probable annual output of British India is 6,773,333 bales, the gross value of which would not be less than £13,500,000 sterling.

INDUSTRIAL USES.

The jute plant supplies the fiber which, when woven into bags, sacks the cereal grains, the coffee, and the sugar crop of two hemispheres. It also affords the outer protecting cover for the millions of bales of cotton and wool grown throughout the world. The most extensive manufacture of bags and bagging is probably carried on in Dundee, Scotland, but vast quantities are manufactured in England and the United States. Notwithstanding enormous manufacture in the latter-named country, it is still under the necessity of importing millions of sacks from India annually.

Among manufacturing countries India is now well in the lead, reporting in the year 1902 no less than fifty jute mills, giving employment to 114,000 operatives.

MINOR USES.

In the aggregate, the consumption of jute in lesser manufactures amounts to a formidable total. It is most largely used in—

(1) The making of rugs and carpets.
(2) In the manufacture of cheap plushes and velvets.
(3) In the manufacture of twines and cordage.
(4) As an adulterant (when bleached) in cotton fabrics.
(5) As an excellent stock for the manufacture of the so-called "finest linen paper."
(6) When bleached and carbolized it often replaces cotton for surgical uses.

LOCAL USES.

In addition to the foregoing, the tender leaves and young tips of the jute plant are highly appreciated when cooked as "greens," and from its abundant seed a good quality of oil and a press cake valuable as cattle food are frequently taken.

THE JUTE PLANT.

Jute is derived from two species of *Corchorus*, indigenous to northern India, known respectively as *Corchorus capsularis*, and *C. olitorius*. From these have sprung many varieties whose repute and value are determined according to the purpose for which the fiber is desired. Of eleven kinds in common cultivation I have been given the names and characteristics of the five most widely grown and held in most esteem. They are as follows:

(1) *Deora* or *Dourah.*—Grown chiefly about Faredpur, and famous for its strength and utility in the manufacture of twines.

(2) *Desi.*—A dark-colored fiber of long, fine staple, grown mostly in the Calcutta district for the manufacture of bagging.

(3) *Narainganji.*—Grown mostly about Dacca. Employed in fine weaves and valued for the length and suppleness of its fiber.

(4) *Serajganji.*—From Pubna and Mymensingh; is esteemed for the same uses as No. 3.

(5) *Uttariya* or *Attariya.*—This has the longest, strongest, whitest, and most brilliant fiber of any, and has been recommended as the variety of most general utility. It is grown chiefly in Rungpore, Bogra, Mymensingh, Kuch Behar, and Julpaiguri.

Both of the Indian species of *Corchorus*, to the untrained eye, have a striking resemblance. Both are tall, herbaceous, sometimes woody annuals from 1 to 5 meters high, according to the fertility of the soil in which they grow. Both are very sparingly branched and have smooth, ovate-lanceolate, toothed leaves. Both have similar-appearing small yellow flowers, placed singly or in pairs in the axils of the leaves, and these flowers are succeeded by a many-seeded, beaked capsule.

Although the two species are productive of good jute, the most desirable varieties seem undoubtedly to have been derived from *C. capsularis*, and it therefore becomes a matter of serious importance to the planter to discriminate between the two species. While there are many characteristics that enable the botanist to differentiate them, there is only one that appeals to the untrained. This, fortunately, is so well marked that the most inexpert may detect the difference. The seed capsule of *C. olitorius* is perfectly cylindrical, while that of *C. capsularis* is not only globular but is slightly flattened on the summit.

The names previously given are largely local, but in all parts of India, or at least in the Bengal presidency (the seat of greatest production), the difference between "jute" and "Nalta jute" is widely recognized, and planters writing for seed and desiring to plant *C. capsularis* should be careful to specify that they want "jute" and not "Nalta jute," as *C. olitorius* is called.

CULTURE.

SOIL AND SITE.

Strong, moist, bottom lands, the richer the better, present ideal conditions for jute growing. As drought, soil or atmospheric, is prejudicial to success, dry-season planting and gravelly uplands are both, of course, contraindicated. Lowland paddy lands, such as abound along the line of the Dagupan Railroad or upon the west shore of Laguna de Bay, are unexceptional for this purpose. In fact the occasional rotation of our rice fields to jute would be beneficial to the farmer in more than one way. In India this rotation is extensively followed, it having long ago been ascertained that cropping of jute exterminated those weeds whose burden makes the rice planter's life no sinecure. It is there held that some quality in the jute plant is inimical to weed growth, but the probable cause is the smothering out of weed life, owing to the rapid growth and dense shade afforded by the jute. But the chief advantages it affords lie in the crop rotation, in a diversity of products, and in utilizing the lands during the wet season when they could not be devoted to lowland rice without the irrigation that the jute plant does not demand.

At this time no positive assurance can be given of the immunity of this plant from the attacks of locusts, but it can be said that when locusts swarmed upon the trial grounds of this bureau the jute plants growing thereon were not molested. Further, from having carefully remarked the complete exemption from the attack of these pests over wide areas of wild, congeneric plants, we have fairly tenable grounds for believing that the whole order *Tiliaceæ* (to which the jutes belong) may prove unsusceptible to their ravages.

SOIL PREPARATION.

Jute seed is exceedingly small, and any successful scheme of soil preparation is one that looks to the end of a surface seed bed reduced to a fine state of pulverization.

Most paddy lands (by virtue of the puddling they receive in rice growing), when plowed, break in a rough, cloddy condition. Such lands can be worked down only by repeated disking and breaking with a clod crusher or a roller. If the planter has not at his command the appliances to effect this, he should turn his attention from paddy lands to any substantial free-working bottom land that, with a single plowing and a few applications of the smoothing harrow, can be reduced to a good degree of comminution. Advantage should be taken of the first rain of the season to get the soil rapidly in condition for sowing. Very early planting is one of the features upon which success hinges. The reason that makes early planting an essential lies in the fact that when the jute plant is small it is sensitive to excess of moisture at the root. When, however, it has attained to a height of 50 to 60 centimeters, it will endure a measureable inundation without detriment. Our rain monsoons, in this as in most tropical countries, are cumulative, reaching their maximum about mid season, and then as gradually declining. Early planting, therefore, admits of the crop reaching such a state of growth as will safely tide them over the normal period of prolonged rainfall.

Jute is not an aquatic, and if planted in paddies the flush gates should be broken down to permit of the free escape of excess rain water.

SOWING.

Sowing in India is generally done broadcast, the seed being mixed with an equal quantity of dry sand and scattered at the rate of 5 to 10 kilos per hectare. This wide range in seed sown is premeditated and the sowing is 5 pounds or 10 kilos, precisely as it is desired to produce a fine or a coarse staple. There is a specific market for each, and growers cater to these demands. After sowing, the land is lightly harrowed and rolled. If the planter lacks facilities for rolling his land, then the use of the drill is to be recommended. By drill sowing in rows 15 centimeters apart the writer secured an excellent "stand" of jute in 1903 during a season of unparalleled drought and when broadcast sowing could not have resulted other than disastrously.

If perfect soil preparation has been given, the seed will sprout in three days and take, to the exclusion of weeds, immediate possession of the land, thus obviating other cultural requirements until the time of harvest arrives.

HARVEST.

Jute should come into flower about four months after planting, and it is at this stage that the stems furnish fiber of the finest and highest-priced quality. Left until the seed has fully matured the yield is considerably increased, but at a sacrifice of value. On large estates it is not always practicable to handle a big crop in flower. In that case the fiber from the flowering stems is kept carefully separated from that which has fully matured. Cutting is done with a sickle or a stout scythe, but demonstrations in India have shown that the crop can be cut with a mowing machine with a consequent vast saving of labor.

The cutting is made at about 10 centimeters from the ground, the stems sorted roughly into loose heaps of 50 or 60 of approximate lengths. These are left exposed on the ground until the leaves begin to freely drop, and are then carried to the water side for retting. Retting is effected in stagnant or running water by placing the bundles, butts outward, into the water and weighting them down with loaded planks.

A quicker fermentation and quicker returns of the finished products is obtained in stagnant water, but a more brilliant and higher-priced fiber is obtained when retted in flowing water.

The temperature of the water and the physical condition of the stems are important factors in the time of the operation, flowering stems in warm, shallow waters fermenting in one-half or one-third the time required by indurated stems in a cooler medium.

When the pulp "slips" freely, the process of fermentation has sufficiently advanced, and the operation of decortication is then easily effected by a workman entering the water, gathering a bundle of the stems, and beating them a few times upon the surface of the water. The solvents easily separate and leave in his hand a bundle of the pure fiber.

The remaining steps consist now in washing the fiber in clean water, exposing to the sun until dry, and in packing in bales of 5 maunds (about 180 kilos). The article is then ready for market.

PRODUCTION AND VALUE.

The productive range per unit of area in India (influenced as that country is by seasons of capricious rainfall) is very wide, sometimes falling as low as 600 kilos, and yet having recorded maximums as great as 6,000 kilos per hectare. These figures, based upon present Dundee prices of £12 per English ton, show a value range varying from £9 to £90 per hectare.

From the Bengal presidency it is stated that average production over large extensions is about 10½ maunds per acre. This, reduced to conventional terms, would be almost exactly 1 metric ton per hectare. As the metric ton is only 36 pounds less than the English standard we accept the latter and its value, or £12 per hectare, as a fair and conservative average of value.

REMARKS.

It is generally conceded that few cultivated crops exert a more impoverishing soil influence than jute. Hence, it is the almost invariable practice in India to regularly manure the land on which it is grown as a continuing crop. Failing manure, it is rarely grown except as an occasional rotation with rice. When manured, it is followed the same year with rice, and the better crops of both rice and jute obtained liberally compensate for the manurial outlay and maintain as well the productivity of the land. There a large dependence is placed on yard and stable manures. As like conditions do not generally obtain in the Philippines, recourse would have to be had to imported commercial manures and an occasional injection into the rotation of "Kibal," "Mani," or "Mungo."

The labor of retting and manipulating the fiber is adapted to the work of women and children, and the art is most easily acquired. The French Government is making strenuous efforts to get the industry upon a stable footing in Anam, and M. Hautefeuille, of Hanoi, in a recent communication,[a] declares that he saw 50 workers—men, women, and children—sufficiently instructed in one hour to become fairly expert in the manipulation of the fiber.

A further consideration that strongly commends its cultivation to this country is found in the general familiarity of much of the native population with the detail of weaving textile fabrics. There is overproduction to-day in many of the finer products of the native looms, a condition of affairs quite impossible to conceive of were their efforts and talents directed to the weaving of jute fabrics.

Imports of raw and finished products of jute into the United States during 1901 were $5,172,942, and in 1902 increased to $5,266,407.[b] It is certainly worthy of effort to attempt to divert a portion of this considerable commerce to these islands.

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[a] Journal d'Agriculture Tropicale, No. 30, December, 1903, page 359.

[b] United States Treasury Reports for 1903.

BUREAU OF AGRICULTURE.

(Farmers' Bulletin No. 12.)

ABACÁ (MANILA HEMP).

By H. T. Edwards, 1904.

LETTER OF TRANSMITTAL.

Sir: I have the honor to transmit herewith, and to recommend for publication as a farmers' bulletin, the manuscript of a paper entitled "Abacá (Manila Hemp)."

The production of abacá has been for more than half a century the most important industry of the Philippine Islands. The exports of abacá for the year 1903 were more than 2,000,000 piculs, valued at $21,701,575, which represents 66 per cent of the total exports from the islands. The present condition and future prospects of the industry are very encouraging. Many new plantations are being developed, and the exports of fiber show a large increase in production each year.

Favored by every condition of soil and climate, and meeting but little outside competition, it is not surprising that this industry has attained its present position, even with primitive methods of culture. The time has come, however, when the old system of "bolo" cultivation should be supplanted by more modern methods, and when the fiber-extracting machine should take the place of the antiquated "panguijan." With the increasing use of sisal and other cordage fibers, it is of imperative necessity that more attention be given to the production of a superior quality of abacá.

This paper is a brief statement of the more essential details of the abacá industry. Its purpose is to suggest to the veteran "hacendero" certain lines of improvement which are demanded by present conditions, and to offer the prospective abacá planter the elementary information required in establishing a new plantation.

Very respectfully,

H. T. Edwards, *Fiber Expert.*

Prof. W. C. Welborn,
Acting Chief, Bureau of Agriculture.

INTRODUCTION.

The fiber produced by the plant *Musa textilis* is known throughout the civilized world as hemp, manila, or manila hemp. This name "hemp" is misleading as, properly speaking, hemp is the fiber produced by the plant *Cannabis sativa.* The two fibers are quite different, manila hemp being a structural fiber obtained from the leaf sheath, while true hemp is a bast fiber extracted from the inner bark of the stem. The name "abacá" is used in all parts of the Philippine Archipelago to designate both the plant, *Musa textilis,* and the fiber, manila hemp.

Abacá enjoys the unique distinction of being strictly a Philippine product. The plant has been introduced into India, Borneo, the West Indies, and other parts of the world, but only in the Philippine Islands has the fiber ever been successfully produced as an article of commerce. This fact has undoubtedly been of great advantage to the Philippine planter. The lack of competition, however, has resulted in the continuance of obsolete methods of cultivation and fiber extraction, better suited to the eighteenth than to the twentieth century.

Note.—The following illustrations accompanying this report are on file in the War Department:

Plate 1. A field of abacá at the San Ramon government farm. Plate 2. The fruit of abacá. Plate 3. Stripping abacá (first process). Plate 4. Stripping abacá (second process). Plate 5. Drying abacá fiber, Sorsogon Province, Luzon. Plate 6. Tinampipi and sinamay, fine and coarse abacá cloth.

The opportunities for increasing the production of abacá in the Philippines are almost unlimited. Enormous areas of good abacá land are as yet untouched, while the greater part of the land already under cultivation might yield a greatly increased product if more careful attention were given to the various details of cultivation. The introduction of irrigation will make possible the planting of abacá in many districts where it is now unknown. The perfection of a machine for the extraction of the fiber will increase the entire output by nearly one-third, as this amount is now lost by the wasteful hand-stripping process.

In each successive step, from the first selection of the land to the final treatment of the fiber, the progressive planter should have as his ultimate object the production on a given area of a maximum quantity of superior fiber at a minimum cost. With the industry established and conducted on this basis, abacá will continue to hold its place as the first product of the islands.

HISTORY.

The first authentic account of the use of either abacá or banana fiber in the Philippines is that given by an Englishman (Dampier), who lived in Mindanao in 1686. This writer describes the "banana textoria," both as an edible and as a fiber-producing plant. One of the companions of Magallanes, Antonio Pigafita, prepared a description of the plants of the Philippines, but in this paper no mention is made of abacá. The fiber was first exported from the islands about the beginning of the last century, but the exports did not become important until about 1850. In 1820 a sample of abacá was brought to Salem, Mass., by John White, a lieutenant in the United States Navy. From 1824 to 1827 the fiber began to be used quite extensively in Salem and Boston. The gradual increase in production is shown by the following table:

Exports of abacá from the Philippine Islands.

	Tons.		Tons.
1818	41	1870	31,426
1825	276	1880	50,482
1840	8,502	1890	67,864
1850	8,561	1900	89,438
1860	30,388		

The numerous attempts which have been made to introduce abacá into other countries have never met with any considerable degree of success. In 1822 experimental plantings were made in Calcutta, and in 1877 in Madras. The plants grew fairly well in both instances, but the fiber produced was of an inferior quality. The experiments with abacá in the Andaman Islands, Borneo, Florida, and the West Indies have not resulted in any general introduction of the plant into these countries.

BOTANY.

The common banana, *Musa sapientum;* the plantain, *Musa paradisiaca;* and abacá *Musa textilis*, are closely related species of the same genus. The plants of these three species resemble each other both in appearance and in habits of growth. The banana plant produces a fiber similar in appearance to abacá, but lacking strength. The fruit of the abacá somewhat resembles that of the banana, but is smaller, filled with black seeds, and of no economic value.

The abacá plant is a large tree-like herb 15 to 25 feet high. The stem arises from a perennial rootstock. A single rootstock usually bears a cluster of from 12 to 20 stalks or shoots. The stem is cylindrical, green, 15 feet or more long, and is formed of the overlapping leaf sheaths. The leaves are oblong, deltoid at the base, bright green above, glaucous beneath, petiole from 1 to 2 feet long. The flower bud remains at the root until after the plant has attained its full size and then pushes rapidly upward. From the center of the leafy envelopes at the top of the stem emerges the flowering spike, which varies greatly in size and length with different species. The flowers are borne in clusters, arranged at intervals along the rachis, each cluster being subtended by a large membranous bract. These bracts are very conspicuous, entirely cover the half whorls of flowers, and are so densely laid one upon the other that they form a kind of flower cone. This cone is usually a dull violet color, smooth, and glossy. The fruit is green, oblong trigonous, 2 to 3 inches long, 1 inch in diameter, not edible, but filled with large, black seeds.

While the abacá plant quite closely resembles the banana, the two may be easily distinguished. The abacá is ordinarily smaller than the banana, its stem is more slender and of a darker color. The abacá leaf is a darker green, narrower, more tapering, and of a firmer texture than that of the banana. A peculiarity of abacá is a dark, thread-like line running lengthwise on the right-hand side of the undersurface of the leaf.

There are many different varieties of abacá, often 12 or 15 in one locality. The principal differences between these varieties are in color and shape of stem, color and size of leaves, greater or less tendency to produce suckers, and in development, resistance, and strength of fiber. The desirable qualities in an abacá plant are: A plant which is hardy, grows rapidly, and withstands drought; which has a stem long, thick, and not too tapering, and which produces fiber in abundant quantity, of good quality, and easily extracted.

DISTRIBUTION.

Abacá is distributed throughout the greater part of the Philippine Archipelago. The area where it is successfully cultivated lies, approximately, between the parallels 6° and 15° north latitude and the meridians 121° and 126° east of Greenwich. The most favorable locations are along the eastern and southern coasts. It may be cultivated up to 1,000 or 1,200 meters above sea level, but above this height the temperature is not favorable to its best development. The more important abacá provinces and islands are as follows: Camarines, Albay, Sorsogon, Masbate, Mindoro, Marinduque, Samar, Leyte, Panay, Negros, and Mindanao. It is grown to some extent in other provinces of Luzon and on many of the smaller islands. The amount of land at present under cultivation, or that which is suitable for abacá, can not be very definitely estimated, inasmuch as the plant is often grown on small and widely scattered areas back in the mountains. The methods of propagation, of cultivation, and of fiber extraction are all very similar in the different parts of the archipelago. The following is a brief statement of the local conditions in several of the more important abacá-producing provinces:

Camarines.—Abacá is cultivated in 27 of the 35 towns of this province. There are three important abacá districts—that of Daet, in Camarines Norte; the Lagonoy district, in the eastern part of the province, and the Mount Iriga district, in the south. These different districts are located on the slopes of old volcanoes, where the soil is rich, deep, and well drained. In these locations abacá has been successfully grown on the same land for over forty years. The important varieties in Camarines are Samorong puti (white abacá), a highly esteemed variety and a heavy producer of excellent fiber; Samorong pula (yellow abacá), also a heavy producer but not yielding as good a quality of fiber; Isarog (mountain abacá), a shorter plant yielding a very white fiber; Quidit, a tall, slender plant producing a long but rather delicate fiber; Saba, butuhan, and tindoc are varieties of banana, the fibers of which are utilized for making fine and delicate fabrics. Abacá land is valued at from $30 to $50 local currency, per hectare. Wages are from 50 to 75 cents per day. Carabaos are scarce. The trees used for shade are dap-dap, ilang-ilang, dau, biluang, alum, and adgao. Cocoanuts, cacao, and coffee are grown on the same land with abacá. A large amount of fiber is used locally for making cloth, cordage, and other materials.

Albay.—Albay is the leading abacá-producing province of the islands. It is estimated that half of its area is devoted to abacá. The soils of Albay have been largely derived from the ashes and dust of the Mayon Volcano and are quite similar to those of Camarines. The rainfall, showing an annual average for six years of 118.42 inches, is heavier than that of any other abacá province. The important varieties of abacá are Samorong itom, Samorong pula, Samorong puti, Samina, Inisarog, Sabaon, and Canaraon. Of these varieties, the first three are superior, as they grow rapidly, resist drought, and produce a good quality of fiber. Cultivated land is valued at $200 to $300 per poisoson (3.472 acres). Labor is worked on the share system. Carabaos can be bought for about $150 each. The abacá shade trees are dap-dap, taloto, naga, and anonang. The relative production of different grades of fiber is as follows:

	Per cent.
Superior current	1
Current	7½
Dudoso (low current)	78
Seconds	9
Reds	4
Strings	½

The exports of fiber from Albay for 1903 were 263,585 bales. The manufacture of sinamay (abacá cloth) is an important local industry.

Sorsogon.—Some of the best abacá produced in the islands comes from Sorsogon. The greater part of this province is suitable for abacá cultivation, and many large plantations are now being worked. In the southern part of the province is the large volcano, Bulusan, on the lower slopes of which are many fine "lates," or abacá plantations. The soils are rich, mellow loams, similar to those already described. This province has been at somewhat of a disadvantage in having poor harbor facilities and but few roads. The latter are now being improved so that Sorsogon, with its very favorable soil and climatic conditions, should continue to rank as one of the leading abacá provinces.

Leyte.—In quality of fiber produced Leyte is nearly, if not quite, the equal of Albay. Abacá is grown in nearly all parts of this island, some of the best fiber being produced in the southern towns around Malitbog Bay. In this district the country is generally mountainous, but in the northern part of the island we find abacá largely grown on the lowlands. The soil in these locations is a heavy silt loam of alluvial origin. Farther back toward the mountains the soil becomes more sandy. The fiber produced in the northern part of Leyte is forwarded to Tacloban and Carigara, and from these points is shipped to Manila.

Samar.—The greater part of the interior of Samar is a rough, mountainous country, with no roads and poor trails. For some years this island has been in a very unsettled condition, so that there has been but very little development, and many old plantations have been abandoned. Nearly the entire production of fiber is in the northern half of the island, some of the best coming from the valley of the Gandara River. Calbayog, Catbalogan, and Borongan are important shipping points. The two principal varieties of abacá grown in Samar are jilajas, a small plant yielding a white, strong fiber, and lawsig, a larger plant, yielding more fiber but of an inferior quality. Labor is worked on the share system. Carabaos are scarce, and are valued at about $130. But a small portion of Samar is under cultivation. Land suitable for abaca may be found in almost any part of the island.

Davao.—The district of Davao, in southeastern Mindanao, is one of the most promising of the abacá-producing provinces. The climatic conditions in this district are extremely favorable, there being a heavy and evenly distributed rainfall, a high degree of humidity, and freedom from severe winds. The soil is a rich, deep, medium loam, and large areas which have already been cleared of the heavy timber are now in good condition for abacá planting. The fiber produced in Davao is of excellent quality and always commands a high price in the Manila markets.

CLIMATE.

A suitable climate is the first and most important requisite for successful abacá cultivation. In selecting the location for a plantation this subject should receive the most careful attention. The four conditions of climate which directly affect the growth of abaca are the amount and distribution of rainfall, the degree of atmospheric humidity, the frequency of heavy winds, and the degree of temperature.

The structure and habits of growth of the abacá plant are such that it requires a large and continuous supply of moisture. We invariably find that the provinces where abacá cultivation is the most successful are those having a heavy and evenly distributed rainfall. In many parts of the Philippine Islands there is a long and pronounced dry season, during which time there is no rainfall whatever. Unless water is available for irrigation, abacá can not be grown in these districts. A period of six weeks' drought will check the growth of the plant, and longer periods of dry weather will injure both plant and fiber. In Albay, Davao, and certain other localities, while there is a so-called wet and dry season, seldom does a week pass without heavy showers. The actual amount of rainfall required by abacá will be modified by the nature of the soil, the degree of atmospheric humidity, and the methods of cultivation.

The growth of abacá is influenced very directly by the relative humidity of the atmosphere. The degree of atmospheric saturation usually follows the rainfall in its variations, so that in districts where there is a heavy precipitation there are also many days of excessive humidity, the effect of which is almost the same as actual rain. The atmospheric conditions in southern Mindanao are more favorable for abacá cultivation than those of any other part of the archipelago.

The abacá plant with its broad, heavy leaves, may be seriously injured by severe windstorms. The function of the leaf is to assimilate plant food. When it becomes stripped and torn, as is often the case, this power of assimilation is diminished and the growth of the plant is correspondingly retarded. It is always desirable to select locations as protected as possible, and it may be found necessary to plant trees which shall serve as wind-breaks.

No investigations have been made relative to the degree of heat necessary to the growth of the abacá plant. If a sufficient amount of moisture is available to supply the heavy evaporation, it can doubtless withstand a high degree of temperature.

A low temperature is very unfavorable to its best development. The maximum and minimum temperatures for Leyte and Albay—the two most celebrated abacá-producing provinces—for one year were 33.80° to 22° C. for Leyte, and 32° to 18.20° C. for Albay.

The following table shows the average rainfall and temperature in certain parts of the islands:

Province.	Number of years averaged.	Temperature.	Days rain.	Rainfall.
		° *C.*		*Inches.*
Albay	6	26.05	218.5	118.42
La Carlota (Negros)	10	26.5	154.3	103.65
Mamburao (Mindoro)	2	....	147.5	124.65
Iloilo	4	....	152.6	71.84
Davao	2	....	187	79.82
Cebu	6	....	161	58.88

SOIL.

Next in importance to favorable climatic conditions is the selection of a suitable soil. The appropriateness of any particular soil must depend in a degree on the relative conditions of climate and location. For instance, in a district having a very heavy rainfall and where the land is low and flat a soil of certain consistency would become oversaturated, while the same soil, if the land were sloping and the rainfall less heavy, might be sufficienty well drained. The qualities to be selected are a rich, mellow loam of lasting fertility, cool and moist, but at the same time well drained, containing a large amount of decayed vegetable matter, and preferably of volcanic origin.

Throughout the important abacá districts of southern Luzon we find nearly all of the large plantations situated on the lower slopes of old volcanoes. The soils in these locations are deep and fertile, well drained, and in every way desirable. As abacá is grown on the same land without replanting, fertilizing, or rotation for a period of at least twelve or fifteen years, the soil must be of lasting fertility in order to stand this long drain on its resources. The demand of the plant for a constant supply of moisture and its equal dislike for over-saturation require a condition of medium consistency—a soil that will retain moisture without becoming wet.

The foothills and lower mountain slopes covered with a medium growth of timber furnish the ideal location for a plantation. Here we have land well drained and shaded, and filled with decayed vegetable matter. On such land abacá can be successfully grown for an almost indefinite length of time.

THE PLANTATION.

The prospective planter must consider three things: The selection of a location, the preliminary work of establishment and organization, and the system and method by which the plantation is to be developed.

The location should be, if possible, in some district where abacá is already grown. This will be the surest way of determining that soil and climatic conditions are suitable, and will also guarantee a supply of suckers, or "seed," for starting the new plantation. The supply and quality of available labor; the condition of roads and the facilities for water transportation; the supply of water, wood, and building materials, and the distance from a market are all matters that should receive consideration.

The site having been selected, the boundary lines should be carefully located and the plantation mapped out with a view to future development. At some central point, where there is a supply of good water, the necessary buildings may be erected. These will include a residence for the manager, a storage shed for tools and implements, and a shelter for animals. As soon as this preliminary work is finished the clearing and planting should be commenced.

The most difficult problem which the tropical planter has to face, and that which more than any other one thing will determine his ultimate success or failure, is the manner in which he controls and directs his labor. To have available at all times as many workmen as can be used to advantage, and to so handle them as to secure the best results, requires a thorough knowledge of the native character and an infinite amount of tact and patience. When the plantation is first started arrangements should be made for building a native village of sufficient size to accommodate all laborers needed on the plantation, together with their families. By this method the plantation manager will always have under his direct control a fairly reliable supply of labor; and if this system is properly carried out the workmen will be more contented, better satisfied, and in every respect more easily handled than if secured in any other way.

PREPARATION OF THE SOIL.

The land should be first cleared of all growth except such trees as are to be left for shade. Any valuable timber having been removed, all other material is left on the ground for about thirty days, or until thoroughly dry, and is then burned. This burning clears the ground of all waste, destroys a portion of the seeds of weeds, and leaves an amount of ash, the potash salts of which furnish a valuable fertilizing material. All clearing and burning should be finished before the close of the dry season.

The preparation of land for abacá must vary with different local conditions. The most common practice is, after the land has been burned over, to plant at once, without any preliminary plowing or other preparation of the soil. The abacá shoots are set out at regular intervals, camotes (sweet potatoes) being planted at the same time. The latter grow rapidly, soon cover the ground with a dense growth, and thus to a large extent prevent the growth of weeds. This method may be followed where it is impracticable to secure labor, animals, or implements, or where the land can not be thoroughly cleared. It is not, however, a system to be recommended. Where it is practicable to do so, the land should be plowed and harrowed before planting commences. This system will be more expensive at the outset, but the more rapid growth of the crop and the increased yield on land thus prepared will, in the end, more than pay for the additional first cost.

PLANTING.

The land, when ready for planting, should be lined out with a cord or bamboo poles and small stakes driven at equal distances apart where the plants are to be set out. Some of the plants will fail to grow, and without these stakes it will be difficult to determine the exact spot for making the new setting. The rows should be from 9 to 12 feet apart each way, depending on the size of the variety of abacá planted and on the nature of the soil. This will give from 750 to 1,350 plants to the hectare (2.471 acres). The most favorable time for planting is near the beginning of the rainy season.

A new plantation may be started with seed, suckers, or root sections. The one advantage of using seed is that the first cost is less. This method, however, is seldom followed, as it requires from six months to a year longer for the plants to mature from seed than from suckers or root sections. Good seed is difficult to secure, and even when every possible precaution is taken it often fails to germinate. The seeds of the ripe fruit should be selected, well washed to remove the pulp, and dried. Before planting, soak in water for some five hours and use only the seed which sinks to the bottom. Prepare the seed bed carefully in moist, fertile soil and sow in drills 1 to 2 feet apart. The plants should be large enough to set out in the field at the end of nine months to a year.

The ordinary method of propagation is by the use of suckers. These suckers grow from the root of the "mother plant," and can be obtained on any large plantation at a cost of from $15 to $25 per thousand. Care should be taken to secure suckers that are well developed and in good condition. It is always safe to allow for the loss of one-fourth the original number ordered during the period of transportation and after planting.

The use of root sections is a very desirable method of propagation. When a stalk of abacá is cut for fiber a portion of the root may be removed and set out to start a new plant. These roots are cheaper, more easily transported, and more liable to grow than suckers.

It is customary to plant some other crop on the same land with abacá. This system is advantageous for several reasons. If the ground is sloping some herbage plant is necessary to prevent soil washing. Such plants will also prevent, to a considerable extent, the growth of weeds and will yield a product of more or less value. Camotes is the crop most commonly used. This plant grows rapidly, soon covers the ground with a dense mat of vines which choke out the weeds, and it also furnishes a supply of food for the laborers on the plantation. Corn is very desirable, and it has the additional advantage of furnishing a much-needed shade to the young abacá plant. Where soil conditions are favorable cocoanuts may be grown on the same land with abacá. Cocoanuts and abacá make a very profitable combination, as the abacá can be harvested until after the cocoanut grove comes into bearing. Other crops sometimes used are mountain rice, cacao, and coffee.

CULTIVATION.

Under the present system, where camotes are planted with abacá, the only cultivation given is to keep the soil loose immediately around the abacá plants, thus allowing the free growth of suckers, and the frequent clearing of grass and weeds. It will be necessary to go over the plantation every two months or oftener during the first two years. After the abacá begins to shade the ground the growth of weeds will be less, and after the third year one or two clearings every twelve months will be all that is required.

When the land is thoroughly cleared and plowed before planting, and the abacá is set in straight rows, subsequent cultivation may be done with animals. Under these conditions one native laborer with a carabao can take care of 20 acres at a cost of $15 per month. At the San Ramon government farm both of the above methods have been followed. The results have shown conclusively that where abacá is kept thoroughly cultivated its development is much more rapid and the condition of the plants is far superior than where it is grown with camotes and without cultivation.

SHADE.

The relative advantages and disadvantages of growing abacá under shade is a subject concerning which there is great difference of opinion and one which must be largely decided by the existing local conditions. In any province where there is a pronounced dry season the shade tree may be considered an absolute necessity. Throughout the greater part of the abacá-growing districts it may probably be used to advantage. In certain portions of southern Mindanao, and in other localities where the rainfall is very heavy and is evenly distributed, shade may be dispensed with altogether.

The functions of the properly selected shade tree are as follows: It protects the young abacá plant from the direct and glaring rays of the sun, such protection being very necessary at this stage of growth; it prevents, in a measure, the great evaporation which would otherwise take place from the broad surface of the leaves of the fully developed plant; it brings toward the surface of the ground, within reach of the roots of the abacá, a certain amount of soil moisture; it protects the plant during all stages of growth from severe winds.

The objections to the shade tree are that when it has to be planted it is an additional item of expense; it interferes with the work of cultivation and takes up a considerable amount of land which might otherwise be planted to abacá. If its leaves are large more or less moisture will be evaporated from them and wasted, and if its roots are shallow the abacá plant will be robbed of a portion of its food. If planted too closely the abacá will not receive a sufficient amount of light and heat and its development will be retarded.

If shade trees are to be left standing when new land is cleared, or if trees are to be planted for this purpose, varieties should be selected which have tall trunks, narrow leaves, and deep-feeding roots. Such trees will give a light shade, will not impede the rainfall, and their roots will be beneficial, rather than detrimental, to the abacá. There are many different varieties of trees in the islands which are suitable for this purpose, among which may be mentioned the dap-dap, raran, tanguil, anonang, pili, and barobo. The number of trees required will vary with local conditions. Ordinarily they should be from 20 to 30 yards apart. In all cases where shade trees are not used, corn or some other quickly grown crop should be planted to protect the young abacá during the first months of its growth.

FERTILIZERS.

Commercial fertilizers have seldom, if ever, been used in the growing of abacá. Virgin land, where the soil is deep, fertile, and filled with decayed organic matter, is usually selected for this purpose. When the plant is cut and the fiber is extracted all of the waste material, which constitutes by far the greater part of the plant, is left on the ground. This practice results in the return to the land each year of a large amount of organic matter, and tends to keep up the fertility of the soil. Under these conditions abacá has been successfully grown on the same land for over forty years.

The rapid growth of abacá on land that has been recently burned over, together with the fact that chemical analysis shows a large percentage of potash in the composition of both plant and fiber, indicates that the application of ashes or other potash fertilizers would be attended with beneficial results. Until a series of systematic experiments with different fertilizers have been made, their relative value for abacá or the practicability of their application can not be definitely stated.

DRAINAGE AND IRRIGATION.

The most important requisite for successful abacá cultivation being an abundant supply of water, and one of the most undesirable conditions being a wet soil, the value of both irrigation and drainage becomes very apparent. Notwithstanding these facts, no systematic attempt has ever been made either to drain or to irrigate an abacá plantation. Locations are selected on sloping land and where there is an abundant rainfall. If nature has not directly supplied all of the required conditions, the situation is considered unsuitable. The direct results of growing abacá with irrigation in districts where the rainfall is insufficient and where the degree of atmospheric humidity is low have yet to be determined by experiment. Unquestionably, however, the introduction of even simple methods of irrigation and drainage would largely increase the area that might profitably be planted to abacá. The worse enemy of the planter is a long dry season. If this condition could be met with an abundant supply of water this danger would be largely removed.

The introduction of any thorough system of underground tile drains, or the use of any very expensive methods of irrigation, can hardly be considered practicable where the amount of cheap unoccupied land is as large as it is at the present time in these islands. On many plantations, however, there are opportunities for utilizing, at little cost, an available water supply, or of draining by means of surface ditches, the cost of which would be inconsiderable when compared with the beneficial results.

ENEMIES.

The enemies and accidents to which abacá is subject are but few. The damage done is usually slight and comparatively easy to correct.

Severe winds, which strip and tear the leaves of the plant, will retard its development, and a typhoon may do a great amount of damage. The selection of a protected location and the planting of trees for wind-breaks will, in all ordinary cases, overcome this difficulty.

Extreme drought is another unfavorable climatic condition. A long dry season seldom occurs in the localities where abacá is most largely cultivated, and the effects of dry weather are in a measure overcome by the use of shade trees. Abacá should not be planted in the provinces where the rainfall is not fairly evenly distributed unless some means of irrigation are available.

Wild pigs, deer, and carabaos occasionally do some damage, and it is usually necessary to fence a plantation. Locusts and ants are not to be feared. The larvæ of two insects, known locally as "tamilos" and "amasog," sometimes attack abacá. The first of these is about 4 centimeters long, has a body divided into 12 segments, a soft, white skin, a head of a dark-red color, and strong mandibles. The latter is about 1½ centimeters long with a body of uniform dimensions and white in color. When a plant is affected a relatively large hole is found in the trunk and the leaves turn yellow. Such a plant should be immediately removed and burned. Fortunately but few plants suffer from these insects and the total injury which they do is insignificant.

HARVESTING.

The first stalks will be ready for cutting at from twenty months to three years after planting. The time required for development varies considerably with different varieties and in different localities. After the first harvest it is customary to cut over a plantation about every eight months.

The abacá plant, when mature, consists of a group or cluster of from 12 to 20 stalks, all growing from the one root. These stalks are in all stages of development, but usually two or three will mature and can be cut at about the same time. The stalk is ready for cutting between the time of the appearance of the flower and the development of the fruit. If cut either before or after this period an inferior quality of fiber will be obtained. When the plant is in flower the large violet-colored flower bracts fall to the ground, making it an easy matter when passing through the field to select the plants which are ready for cutting.

The stalk is cut with a bolo or knife having a sharp blade. This cutting should be made 2 or 3 inches from the ground and on a slant. If a perfectly horizontal cut is made, water will collect on the stump, causing it to rot and thus injuring the root and the remaining shoots. After the stalk has been cut the leaves are trimmed off and it is then ready for the first operation of fiber extraction.

EXTRACTION OF FIBER.

The extraction of fiber should commence within twenty-four hours after the cutting of the stalk. If left a longer time than this the fiber is liable to become discolored and weakened. As the abacá trunk is heavy and the fiber-extracting apparatus is light and easily transported, it is customary to move the latter from place to place and to extract the fiber near the spot where the plant is cut.

The trunk or stalk of abacá is often 12 or 15 feet long and from 1 to 1½ feet in diameter. This trunk consists of a small, central fleshy stem, 1 or 2 inches in diameter, around which are a large number of thick, overlapping layers, each layer being the stem or petiole of a leaf. The fiber is obtained from the outer portion of these leaf stems. The process of fiber extraction consists of two distinct operations: First, the removal of the ribbon-like strips of fibrous material from the leaf stems, and, second, the separation of the individual fibers by pulling these ribbons under a knife.

The laborer, sitting on the ground with a trunk of abacá across his knees, inserts under the bark of one of the leaf stems a small, sharp piece of bone called a "locnit," and pulls off a fibrous strip 1 to 3 inches wide and as long as the trunk. One stem will yield two or three such strips. When these fiber strips have been taken off, the remaining fleshy material is removed and each consecutive layer is thus worked, down to the central stem of the trunk. The fiber obtained from the three or four outer layers, which are green and hard, will be coarse and dark colored, while that coming from the layers nearest the center of the trunk will be very fine and white. The latter is used for the manufacture of various kinds of cloth.

When a quantity of these fiber strips has been collected, they are carried to some central point where a shed has been erected and an apparatus set up for stripping the fiber. The shed consists of a frame of bamboo poles covered with abacá leaves. The stripping apparatus, or "panguijan," is simple, both in construction and in operation. It consists of a log set in a horizontal position 1 or 2 feet from the ground. On the top of this is fastened a block of smooth, hard wood. Over this block is placed a bolo having a blade about 1 foot long and a handle 1½ feet long. A rattan is attached to the end of the knife handle and connected with a bamboo spring above. Another rattan passes from the handle to a foot treadle. The bamboo spring holds the knife down upon the block, its pressure being easily regulated by lengthening or shortening the rattan. By means of the foot treadle the operator raises the knife when he desires to insert or remove a strip of fiber.

In the process of stripping, the operator holds in his right hand one or more of the fiber ribbons and also a short, round piece of wood. These strips are inserted under the knife and are drawn through with a quick, steady pull. The ribbon is then removed and reversed, the cleaned end being wound three or four times around the stick. This process of drawing under the knife removes all of the pulp or fleshy material, leaving in the hand of the operator a small bunch of clean, wet fiber. As the fiber is stripped it is usually assorted into two classes. The work of fiber extraction, while apparently simple, is very exhausting, even for the experienced operator, and many laborers are ruptured by the excessive strain of pulling the fiber strips under the knife. It is a fair day's work to strip 1 arroba (25 pounds), and the fiber stripper will usually work only two or three days a week.

All of the fiber produced in the islands is extracted with this simple apparatus. The color and strength of the fiber—two most important qualities—are determined almost entirely by the manner in which it is cleaned. Two factors in the process affect the quality of the product, the condition of the knife blade and the degree of pressure with which the knife is held upon the base block. With a serrated knife loosely fastened the fibers are only partially separated and only a portion of the pulp is removed; the work is easy, the yield large, and the fiber is inferior in quality. With a knife having a smooth-edged blade and held firmly on the base block, the work of extraction is much more difficult and the waste is greater, but a very superior fiber is obtained. It has been determined by experiment that the same plant will produce either a very superior or a very inferior grade of fiber, depending on the kind of stripping knife used. As a result of using serrated knives the markets have been flooded with enormous quantities of inferior fiber, and cordage manufacturers are continually making complaint about the quality of Manila hemp. The whole future of the industry depending, as it must, on the position which abacá continues to hold in the worlds' markets, it is manifestly to the interest of every producer to discourage the use of the serrated knife.

FIBER-EXTRACTING MACHINERY.

Numerous attempts have been made to extract abacá fiber with machinery. A number of the machines used have been in a measure successful, but some obstacle has always prevented their coming into any general use. The greatest difficulty has been that abacá, being a very long fiber, would not bear the strain of full tension while being cleaned. It has been necessary to wind the fiber around a cylinder or to hold it in two or three places with a clutch in order to lessen this tension. Cylinders of various kinds of material have been used, but all have resulted in a discoloration of the fiber. The machines thus far constructed have all been based on the old hand process of extracting the fiber by stripping. Inasmuch as sisal and other vegetable fibers are now successfully extracted by machinery, and as several American inventors are devoting their attention to the perfection of a machine for extracting abacá, it is probable that such a machine will come into use before many years. The fiber-extracting machine for abacá should be simple in construction, strong, cheap, and portable. It must not break, tangle, discolor, waste, or in any way injure the fiber. The introduction of suitable machinery will do more than any other one thing to advance the interests of the abacá industry.

AFTER-TREATMENT OF FIBER.

Abacá after being stripped is hung on bamboo poles to dry. This drying takes from three or four hours to two days. When thoroughly dry, the fiber is collected, tied up in hanks or bundles, and in this condition is shipped by ponies, carabaos, or cargadores to the nearest market. It is there sold to a Chinese middleman or to the representative of some one of the large exporting firms of Manila. When the fiber reaches the warehouse of the exporter, it is carefully sorted into different commercial grades and is then baled, each bale weighing 2 piculs (275 pounds).

When fiber is to be used locally for the manufacture of cloth, it undergoes a much more elaborate process of treatment. The leaf stems in the center of the stalk are selected and the fiber is often drawn several times under the stripping knife. This gives a product that is fine, soft, and white. If to be used for the finest textures, it is then placed in a wooden bowl and beaten with a mallet until the required fineness and elasticity are obtained. This process gives a fiber that is almost silk like, and some of the cloth made from the best quality of abaca rivals in delicacy and beauty the celebrated fabrics of piña and jusi.

DESCRIPTION OF FIBER.

Abacá fiber of good quality is from 8 to 12 feet long, of a glossy white color, very light and strong, and of clean, even texture. As a cordage material it has no superior, its chief value, particularly for ship's ropes, being its relative lightness and strength. The strength of abaca compared with that of English hemp is indicated by the following figures: A manila rope, 3¼ inches in circumference and 2 fathoms long, stood a strain of 4,669 pounds before giving way. The English rope of the same size broke with 3,885 pounds. In a second test, with a rope 1¾ inches in circumference, the manila broke with 1,490 pounds and the English with 1,184 pounds.

YIELD.

The yield of fiber varies greatly, depending upon the variety of the plant, the soil and climatic conditions, and the methods of fiber extraction used. Under favorable conditions the annual yield will average from 12 to 16 piculs of dry fiber per hectare (687.5 to 967.6 pounds per acre). The average yield throughout the islands is probably below this figure, often not exceeding 6 piculs per hectare. Under careful management the yield may be brought up to 20 or 25 piculs per hectare. From one-third to 1 pound of fiber is obtained from a single stalk. In southern Mindanao, the estimate is 212 stalks for 1 picul of fiber. With 1,250 plants to the hectare and an annual yield of 4 stalks per plant, the returns for 1 hectare would be 23.6 piculs, or 3,245 pounds of fiber.

VALUE.

Owing to the largely increased use of binder twine the prices paid for cordage fiber are much higher at the present time than they were some years ago. The fluctuations in the abacá quotations are indicated by the following table:

Manila quotations for "current abacá." [a]

Year.	Maximum.	Minimum.
1885	$9.25	$6.75
1888	17.00	7.25
1890	14.50	8.62
1892	10.87	8.12
1894	9.00	6.00

[a] Local currency.

The Manila quotations on March 17, 1904, were as follows:

Leyte—	
Good current	$27.00
X current	26.00
Superior	23.50
Second 1	21.75
Second 2	18.50
Second 3	16.75

The relative value of abacá and other Philippine exports is shown by the following table of values for the fiscal year 1901:

Article.	Amount.	Per cent of total exports.
Manila hemp	$14,453,110	62.3
Copra and cocoanuts	2,663,340	11.47
Sugar	2,293,075	9.88
Tobacco, cigars, and cigarettes	2,217,728	9.56
Coffee	6,616	.02

USES.

Abacá is, primarily, a cordage fiber. Its most important use is in the manufacture of various classes of cordage, ropes, and cables. Enormous quantities of the fiber are used in the United States for making binder twine. Because of its lightness, strength, and durability manila hemp is considered superior to any other fiber for ship's ropes and cables. From the old and disintegrated ropes is made the well-known and valuable manila paper. In Europe, especially in France, many different articles of clothing such as shirts, vests, pantaloons, veils, crapes, neckerchiefs, robes, and women's hats are manufactured from abacá. These materials are highly valued, both for their beauty and durability. The fiber is also used to some extent for upholstery, packing, and brush making.

In the Philippine Islands a considerable quantity of abacá cordage is manufactured, and the raw fiber is used without being twisted for all purposes where a tying material is required. Its most important local use, however, is for the manufacture of cloth. The native dress of both sexes in nearly all parts of the Archipelago is made from "sinamay" or abacá cloth. Looms are to be found in nearly every town in the islands. The abacá fiber is frequently woven with either cotton or silk, in an almost innumerable variety of patterns. The fabrics made are of every degree of fineness, from delicate silk-like tissues to the coarse material used for fishing nets. With the introduction of fiber extracting and textile machinery there should be a largely increased demand for abacá as a textile fiber.

UTILIZATION OF WASTE PRODUCTS.

In the extraction of abacá by the methods now in use it is estimated that from 25 to 30 per cent of the fiber is wasted. At each cleaning shed we find large piles of waste which is filled with fibrous material. Experiments which have been made indicate that this waste can be advantageously used for the manufacture of paper. In 1887 samples were delivered to Messrs. Gonzales' Sons, paper manufacturers, of Barcelona, Spain. Their report upon this material was as follows:

"Observations made in the course of manufacture permit us to state that abacá waste as a raw material for the manufacture of paper is not only utilizable, but surpasses esparto and hemp, and in its treatment for conversion into paper, excels rags and other materials known in the industry."

There is an enormous quantity of this waste produced in the different abacá districts, and at the present time it has no other use than as a fertilizer. The abundance, cheapness, and good qualities of this material are such that its utilization is a subject well deserving of attention.

ESTIMATED COST AND REVENUES OF AN ABACÁ PLANTATION.

The following is an estimate of the cost of establishing an abacá plantation. The size of the plantation selected is 250 hectares (approximately 625 acres), which is one-fourth of the amount of land that can be taken up by a corporation in the Philippines under the land law as enacted by the Congress of the United States. Planting 50 hectares a year, it would require five years to put this amount of land under cultivation. With respect to the cost of clearing and cultivating land, and also the yield, there will be considerable variation, depending upon the existing conditions where the plantation is located. This general estimate is prepared from figures obtained from both American and Filipino abacá planters in the islands. It should be stated that practically all labor employed can be paid for in rice, cloth, and other commodities, which will give a profit that should considerably more than pay for all incidental expenses that may occur. All accounts in this statement are in Philippine currency.

Estimate of the cost of establishing an abacá plantation.

FIRST YEAR.

Expendable:	
Cost of 250 hectares, at $10 per hectare	$2,500
Clearing 50 hectares, at $20 per hectare	1,000
Purchase of 50,000 abacá stools, at $30 per thousand	1,500
Planting 50 hectares, at $3 per hectare	150
Cultivation of 50 hectares (first year), at $15 per hectare	750
Fencing and roads	200
Six carabaos, at $100 each	600
Buildings	400
Tools and implements	200
Overseer, at $150 per month	1,800
Incidentals	300
Total	9,400

SECOND YEAR.

Expendable:	
Clearing 50 hectares	$1,000
Purchase of 50,000 abacá stools	1,500
Planting 50 hectares	150
Cultivation of 50 hectares (first year)	750
Cultivation of 50 hectares (second year)	500
Fencing and roads	200
Overseer	1,800
Interest on investment	940
Depreciation on tools, buildings, and animals (20 per cent of cost)	240
Total	7,080

THIRD YEAR.

Expendable:	
Clearing 50 hectares	$1,000
Planting 50 hectares	150
Cultivating 150 hectares	1,500
Fencing and roads	200
Overseer	1,800
Interest on investment	1,648
Depreciation	240
Total	6,538
Income account:	
From 50 hectares, 50 per cent of full crop (full crop from 50 hectares, at 12 piculs per hectare, 600 piculs; one-half paid for cleaning, leaves 300 piculs, at $22 per picul, $6,600)	3,300
Debit balance	3,238

FOURTH YEAR.

Expendable:		
Clearing 50 hectares		$1,000
Planting 50 hectares		150
Cultivating 150 hectares		1,500
Fencing and roads		200
Overseer		1,800
Interest on investment		1,971
Depreciation		240
Total		6,816
Income account:		
From 50 hectares, 50 per cent of full crop	$3,300	
From 50 hectares, a full crop	6,600	
Total		9,900
Credit balance		3,039

FIFTH YEAR.

Expendable:		
Clearing 50 hectares		$1,000
Planting 50 hectares		150
Cultivating 150 hectares		1,500
Fencing and roads		200
Overseer		1,800
Fixed interest on investment and depreciation charges		2,250
Total		6,900
Income account:		
From 50 hectares, 50 per cent of full crop	$3,300	
From 100 hectares, a full crop	13,200	
Total		16,500
Credit balance		9,600

SIXTH YEAR.

Expendable:		
Cultivating 100 hectares		$1,000
Overseer		1,800
Fixed interest and depreciation charges		2,250
Total		5,050
Income account:		
From 50 hectares, 50 per cent of full crop	$3,300	
From 150 hectares, a full crop	19,800	
Total		23,100
Credit balance		18,050

SEVENTH YEAR.

Expendable:		
Cultivating 50 hectares		$500
Overseer		1,800
Fixed interest and depreciation charges		2,250
Total		4,550
Income account:		
From 50 hectares, 50 per cent of full crop	$3,300	
From 200 hectares, a full crop	26,400	
Total		29,700
Credit balance		25,150

EIGHTH YEAR.

Expendable:	
Overseer	$1,800
Fixed interest and depreciation charges	2,250
Total	4,050
Income account:	
From 250 hectares in full bearing	33,000
Credit balance	28,950

NOTE.—After abacá is 3 years old it requires practically no further cultivation. It will produce a full crop without replanting for a period of from ten to fifteen years.

PROSPECTS OF THE ABACÁ INDUSTRY IN THE PHILIPPINE ISLANDS.

The future development of the abacá industry will depend chiefly on the position which this fiber continues to hold in the industrial world. There is every indication that the rapid growth of shipping, the more extensive use of binder twine, the successful application of manila rope as a transmission power, together with other minor uses, will create an increasing demand for abacá that will equal any increase in production. The superior qualities and intrinsic value of abacá are thoroughly well known in all parts of the world. Its only dangerous competitor at the present time is sisal, which is an inferior fiber.

The opportunities for the extension of the industry are almost unlimited. Improved methods of cultivation will largely increase the production on land already planted, while enormous areas now covered with forest are in every way suitable for abacá. The introduction of fiber-extracting machinery should result not only in a large increase in the quantity of fiber produced, but also in a decided improvement in quality.

CONCLUSION.

The abacá plantation of the past has been, in general, conducted in anything but a businesslike manner. Antiquated methods, careless management, and waste have been the rule rather than the exception. The planter of the future who, with carefully selected land, good management, and the intelligent use of modern methods and machinery, aims at the production of a superior fiber at a minimum of cost, has every prospect of ultimate success. With no danger from insects or plant diseases, and but little from unfavorable climatic conditions, abacá is eminently a safe crop. With the present prices and the practically assured future demand, it is one of the most profitable branches of agriculture for the Philippine planter.

BUREAU OF AGRICULTURE.

(Farmers' Bulletin No. 13.)

THE CULTIVATION OF MAGUEY IN THE PHILIPPINE ISLANDS.

By H. T. EDWARDS, 1906.

LETTER OF TRANSMITTAL.

MANILA, P. I., *February 26, 1906.*

SIR: I have the honor to transmit herewith, and to recommend for publication as a farmers' bulletin, the manuscript of a paper entitled "The Cultivation of Maguey in the Philippine Islands."

Very respectfully,

H. T. EDWARDS,
Fiber Expert.

The DIRECTOR OF AGRICULTURE.

INTRODUCTION.

The essential feature of the maguey industry, and that which recommends it to the Philippine planter, is its peculiar adaptability to the conditions prevailing in many parts of these islands.

These conditions are: A long dry season; large areas of arid, impoverished land; a limited supply of draft animals; the prevalence of insect pests and plant diseases; labor that is unaccustomed to the care of crops requiring intensive cultivation; and insufficient capital for the purchase of animals, implements, and machinery. In the cultivation of maguey we meet these conditions with a plant that grows and flourishes through the longest periods of drought; that requires for its best development a thin, rocky, limestone, or coral soil, and which can be grown in beach sand; that can be produced on small farms without the use of a single animal; that is not seriously injured by any insect or plant disease; that needs only a yearly or semiyearly cultivation; and that can, if necessary, be planted, cared for, and harvested with a "bolo."

The maguey plant of the Philippine Islands, the fiber of which is known in Great Britain as manila aloe and in the United States as Philippine maguey, and the heniquen plant of Yucatan, which produces the sisal hemp of commerce, are closely allied species of the genus *Agave*. These two plants have the same habits of growth and are propagated and cultivated by the same methods. The fiber-extracting machines that are used for sisal can be used also for maguey.

The production of sisal hemp has, within a comparatively few years, made Yucatan one of the richest States in the Republic of Mexico. The wonderful development of this industry is indicated by the imports of sisal hemp into the Uuited States which were in 1894, 48,468 tons, valued at $3,742,073; and in 1904, 109,214 tons, valued at $15,935,555, an increase in value of 328 per cent in ten years. The Philippine maguey industry, although on a much smaller scale, shows an equally encouraging growth. The export of maguey fiber from the Philippine Islands for the year 1901 was 875 tons, while for the fiscal year 1905 it was 1,878 tons, an increase of 115 per cent in four years.

This remarkable increase in the production of maguey has been effected in two different ways. The failure of other crops because of drought, insect attacks, or the

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NOTE.—The following illustrations accompanying this report are on file in the War Department:

Plate 1, Maguey field in northern Luzon; 2, Sisal hemp, Hawaiian variety; 3, Sisal field in Yucatan; 4, Harvesting maguey; 5, Harvesting sisal; 6, Maguey field; 7, Cleaning maguey by "retting"; 8, "Pioneer" fiber-extracting machine; 9, "Prieto" fiber-extracting machine.

scarcity of animals has led many Philippine planters first to investigate and then to plant maguey. The introduction of a modern fiber-extracting machine in Ilocos Norte has stimulated the industry throughout that province.

The establishment of this industry on a thoroughly satisfactory basis in the Philippine Islands requires three definite lines of improvement: First, an improved system of planting. It is the almost universal custom of Philippine planters to set out maguey plants but 2 or 3 feet apart. On the Yucatan sisal plantations it has been thoroughly demonstrated that planting in rows 12 feet apart, with plants 4½ feet apart in the row, will give more fiber per acre and fiber of better quality than where the plants are set out closer together. Second, an improved system of cutting the leaves. The Philippine planter frequently commences cutting when the plants are but two or two and a half years old. Following this first premature cutting, each year the plant is denuded of all but a few leaves. This system results in a weakened and stunted plant, and a considerable part of the immature leaves thus harvested contain but little fiber. The Yucatan system of cutting at one time only the mature leaves around the base of the plant keeps the plant always in vigorous condition, and gives more and better fiber. Third, the use of fiber-extracting machines. The Philippine method of retting is slow, expensive, and results in the production of inferior fiber. On all of the larger sisal plantations fiber-extracting machines are now used.

With the more careful selection of suckers for planting, a better system of cultivation, and more judicious cropping, it is only reasonable to expect that the maguey plant which we now have can be improved. Furthermore, the true sisal plant, *Agave rigida sisalana*, which has been imported from Hawaii and is now being grown in the Philippine Islands, gives promise of satisfactory results. The machine question is not a difficult one, as the machines required have already been perfected after long years of trial on the sisal plantations of Yucatan. The wide distribution of maguey throughout the islands, and the very general interest that is now being shown in this plant, will greatly facilitate the development of the industry.

HISTORY AND DISTRIBUTION OF MAGUEY.

The fiber of the heniquen or sisal hemp plant has been utilized in Yucatan for centuries, but only within comparatively recent years has it become an article of commercial importance. The industry is supposed to have been started in Yucatan by the Toltecs about A. D. 1060. In 1783 a commission appointed by the royal Spanish navy investigated this fiber and reported favorably concerning it. In 1839 an association was formed in Yucatan to promote the cultivation of heniquen, but owing to the fact that at this time all of the fiber produced was extracted by the use of crude, wooden implements, the industry was not a profitable one. Realizing the need of a fiber-extracting machine for heniquen, the State government offered a reward of $10,000 Mexican to the inventor of a satisfactory machine. This offer resulted in the invention of the "raspador," from which have come the improved, automatic machines that have made the sisal industry what it is to-day. In 1875 the total export of sisal hemp from Yucatan was valued at $710,124 Mexican. In 1900 it had increased to $22,616,032, and in 1904 it was $32,022,563.

From Yucatan, sisal hemp has been introduced into Florida, the Bahama Islands, the Caicos Islands, Mauritius, the Hawaiian Islands, Cape Colony and Natal, West Africa, Australia, and India. In the Bahamas the sisal industry has attained considerable proportions and is now firmly established. The exports of sisal from the Bahamas are now valued at about $200,000 per annum. In Hawaii 20,000 sisal plants were imported by the commissioner of agriculture and forestry in 1893. Some years later the Hawaiian Fiber Company was formed and it now has 850 acres of sisal under cultivation. It was estimated in 1903 that fully 10,000 acres of sisal had then been planted in Hawaii.

DISTRIBUTION OF MAGUEY IN THE PHILIPPINE ISLANDS.

The maguey plant was probably first introduced into the Philippine Islands from Mexico. It is now known, and is utilized for local purposes, in nearly every province of the Archipelago. Until quite recently the production of maguey as an article of export has been confined to the Provinces of Ilocos Sur and Ilocos Norte. During the past three years, however, many planters in other provinces and islands have given their attention to maguey, so that to-day the industry has obtained a foothold in a number of provinces. The provincial governor of Cagayan has recently reported that 263 hectares of land in that province are now planted in maguey. The provincial governor of Batangas states that in the one town of Nasugbu there are now 6,000,000 maguey plants. From the Provinces of Union, Pangasinan, and Zambales, and from the Islands of Cebu and Negros reports have been received which show that the maguey industry in these districts has passed beyond the experimental stage.

THE PLANT.

The heniquen of Yucatan, *Agave rigida elongata;* the sisal of Hawaii, *Agave rigida sisalana;* and the maguey of the Philippine Islands, recently identified at the Royal Botanic Gardens, Kew, as *Agave cantula*, are very similar plants. All have the short, thick stem; the aloe-like cluster of large, fleshy leaves; and the tall flower stalk, or "pole," which bears a large number of small bulbils, or pole plants. The Hawaiian plant differs from that of Yucatan in having a shorter trunk, leaves smooth-edged, or bearing a few unequal teeth, and the fiber less in quantity, but superior in quality, The Philippine maguey plant has a short trunk, leaves from 4 to 6 feet long, from 2¾ inches wide at the base to 4 inches wide at the middle, and about 1 inch thick at the base; lateral teeth three-fourths to 1¼ inches apart; dark-brown terminal spine one-half inch long, and fiber finer, white, and longer, but less in quantity than either the Yucatan or the Hawaiian varieties.

THE FIBER.

The fiber of maguey is derived from the leaves, and is obtained by separating the pulpy portion of the leaf from the fine filaments, or fibrovascular bundles, which run through this pulp. The fiber is white, or yellowish-white, in color, 4 to 5 feet in length, fine and soft, and more wavy or fluffy than abacá. Another marked quality is its elasticity, which gives it great value when used for cordage that is liable to be subjected to any sudden strain. In strength it is inferior to abacá, but superior to coir, jute, sunn hemp, and Russian hemp.

CLIMATE AND SOIL.

Maguey, if planted in a well-drained soil, will grow in almost any part of the Philippine Islands. Unlike abacá, it requires neither a large, nor a continuous, supply of moisture, but rather an excess of hot, dry weather. It is evident, therefore, that the provinces best adapted to the cultivation of maguey are those where there is a long dry season and a light rainfall. With an abundant supply of atmospheric moisture and a rich, moist soil this plant will grow and flourish, but under these conditions the leaves develop a large amount of pulp and a small percentage of fiber.

A thin, rocky limestone soil, or one made up of partly decomposed coral rock, is best suited for maguey. As the roots of the plant are very sensitive to an excess of moisture, it is most essential that the soil be well drained. Although maguey is frequently found growing in almost pure beach sand, the conditions under which the plant can be most profitably cultivated are indicated by the following statement relative to sisal hemp cultivation in the Bahama Islands:

"I have both read and heard it broadly asserted that sisal will grow and flourish anywhere, no matter how sterile or impoverished the land may be. My observations, however, do not confirm this. I do not mean to convey the idea that really good rich land is necessary for its successful cultivation, but merely to remove the impression, if such there be, that the plant will thrive in dry arid sand, or on rocky land void of soil. Worn-out "provision" and pineapple fields appear to be well suited to its cultivation, while on broken, rocky surfaces, containing innumerable "pot holes" and crevices, in which is deposited the ordinary black or red earth, the plant luxuriates." (Bulletin Royal Kew Gardens, London, 1892.)

THE PLANTATION.

The use of fiber-extracting machines in the Philippine Islands introduces a new and important factor in the maguey industry. Heretofore the Ilocos planters have usually grown maguey in connection with other crops. Rice and corn have been planted on the lowlands where there is an abundant supply of water, and maguey in small "patches" on the rocky hillsides and on any available waste land that could not be used for other purposes. There has been no demand for a large, or for a regular, supply of leaves in any one locality. It has, in fact, been impracticable for any one planter to handle satisfactorily the output of a large plantation. This situation is exactly reversed when a plantation, or a community, is equipped with a fiber-extracting machine. As one improved automatic machine will clean from 50,000 to 150,000 leaves per day, the continuous and profitable operation of such a machine requires a supply of leaves that can only be produced on one large plantation, or on several smaller plantations in close proximity to each other. Even with one of the smaller machines cleaning from 10,000 to 15,000 leaves per day, the planter will be able to handle a far greater number of leaves than has been possible where the fiber has been cleaned by retting. While it is not to be expected that the old method of cleaning fiber will be immediately, or entirely, superseded by the use of automatic fiber-cleaning machines, the more general use of such machines in the Philippine Islands is only a question of time, and with their use will come the establishment of larger and more systematically managed plantations.

A maguey plantation to be economically and profitably worked should consist of a fairly large area and should be reasonably level, so that all parts of it can be reached by good roads. The location having been selected and the boundary lines carefully located, the plantation should be mapped and laid out in fields or sections. The maguey planter has always to consider the question of transportation. Maguey leaves should be cleaned within twenty-four hours after cutting, and as every picul of fiber produced means the hauling of approximately two tons of green leaves from the field to the machine, and as the operation of one of the large machines requires from 40 to 100 tons of leaves per day, the need of having both cheap and quick transportation is apparent. With this end in view, the site selected for the fiber extractor, the baling press, and the storage sheds for fiber should be as centrally located as possible. From this point a main road, or roads, sufficiently wide to allow the use of wagons and also a portable track for cars should extend through the plantation. Crossroads may be about 200 feet apart.

One of the first things to be done on a newly established plantation is to start a nursery, where a supply of plants can be propagated from bulbs or pole plants. Even though suckers may be available and cheap, a good nursery will more than pay for the cost and trouble of its maintenance. Two or three acres of good well-drained land may be selected for this purpose, and this land should be thoroughly plowed and harrowed. The bulbs, which can be secured in quantity from any old plantation, are planted in rows 18 inches apart and 9 inches in the row. In one year the nursery plants should be from 15 to 18 inches high, when they may be transplanted to the field.

PROPAGATION.

Maguey is propagated in two ways, from the small "pole" plants, or bulbils, that are produced on the flower stalk, and from the suckers which grow from the roots of the older plants. When a maguey plant reaches maturity it throws up a tall flower stalk 15 or 20 feet high. On the lateral arms of this flower stalk are born a large number of blossoms and from these blossoms develop small plants 2 to 4 inches in length. These plants fall to the ground when mature, and may then be gathered and set out in the nursery.

The second and more common method of propagation is by the use of the suckers which grow from the roots of the older plants. When a maguey plant is from twelve to eighteen months old it commences to throw out underground runners, or rhizomes. The point of one of these runners upon reaching the surface of the ground forms a sucker, or shoot. From 30 to 40 suckers will be produced by one plant during the first three or four years of its life, after which the number decreases. Where it is possible to obtain suckers cheaply, and in sufficient quantity, this method of propagation is quicker and more satisfactory than the growing of plants from bulbils.

FIELD PLANTING.

Where arid, rocky land is used for maguey there is usually but little preliminary clearing required. Any underbrush, or other growth should be cut and burned during the dry season. As maguey feeds heavily upon potash the ash that is left from this refuse will furnish valuable fertilizing material. The land having been cleared may be quickly lined out for planting by using two poles the length that the rows are to be apart and a line knotted at the distance apart which the plants are to be set. If the land is not of such a rocky character as to make plowing impracticable, it is well to plow several furrows along the line of each row of plants. Where other crops are to be grown with maguey the entire field should be plowed.

The suckers that are to be used for planting may either be taken from the old fields and set out at once in the new plantation or they may be thrown in heaps and allowed to lie in the sun for six or eight weeks. The latter method is very generally followed on the Yucatan sisal plantations and the suckers so treated are said to produce larger and stronger plants than where they are taken direct from one field to another.

The system of maguey planting in the Philippine Islands differs materially from that of sisal planting in Hawaii and Yucatan. Maguey is usually set out but two or three feet apart each way, with the result that when the plants mature the fields become an almost impenetrable jungle. Various systems have been tried by planters in other countries. Some have planted as near as 6 feet apart each way, others as far apart as 9 by 11. With too close planting many leaves are torn and lacerated by the spines of adjoining plants, and the work of cultivation and harvesting is rendered extremely difficult. On the other hand, where the distance is too great, there is unnecessary waste of land. After long experience the Yucatan planters have generally adopted the row system, with plants 4½ feet apart in the row, and rows 12 feet apart, giving approximately 2,000 plants to the hectare. The advantages of the row system are that it facilitates cultivation; admits air and sunlight, which are necessary to harden and strengthen the fiber; expedites the work of cutting and handling the leaves, and gives room for replanting when the old plants are approaching maturity.

An improved system of planting is a reform that is urgently needed in the Philippine maguey industry. Close planting and water retting belong to the same period. With the introduction of fiber-extracting machines should come a system of planting that shall give us cultivated maguey fields where now we too often find only tangled wastes.

CULTIVATION.

A maguey field, after it is once well established, requires but comparatively little attention and cultivation. Where the suckers have been set out with reasonable care the loss will be small. Two or three times a year the fields should be cleaned of weeds and grass, care being taken not to bruise the leaves of the growing plants, as any such injury will result in a discoloration of the fiber. Suckers will begin to grow from the roots of the old plants in from twelve to eighteen months, and such as are not required for setting new fields should be removed and thrown away. The growth of a large number of suckers on any one plant not only lessens the vitality of the plant but also tends to hasten the growth of the pole.

As maguey yields no return for three or four years it is sometimes desirable, while the plants are small, to cultivate another crop on the same land. The practicability of doing this will depend largely on the nature of the soil, maguey frequently being grown on land that will produce no other crop.

"At the Grenada Botanical Station, in the Windward Islands, one-half of a sisal field was planted with corn. It was noticed that the small sisal plants shaded by the corn made far greater progress than those without shade." (Bulletin Royal Kew Gardens, London, 1892.)

In the Bahama Islands similar results have been obtained with both corn and cotton. These crops are not only beneficial in furnishing shade, but they also keep down the weeds and yield a product of more or less value. Camotes (sweet potatoes), which are frequently planted in abacá fields, should not be planted with maguey, as the vines would soon entirely cover the small plants and retard their growth.

The early or late poling of the plant is a consideration upon which may depend the entire success or failure of the industry. It is essential with a crop that yields no return for from three to five years after planting, that it shall continue productive for a considerable number of years without replanting. In the case of maguey the growth of the pole, which is soon followed by the death of the plant, is in part the result of natural conditions, and in part depends on the variety and care of the plant. The life of the Yucatan sisal plant, after the first cutting of leaves, is from ten to twenty-five years, while that of the Bahama plant is from five to eight years. The longer life of the Yucatan plant is due to difference in variety, climatic and soil conditions, and the more careful system of cropping of the Yucatan planters. A humid climate and a moist soil tend to bring on early poling. The careless cutting of leaves, and either long delay in cutting or overcropping, have the same result. If the pole is lopped off as soon as it appears above the leaves, the life of the plant will be prolonged a year or more, allowing the leaves then on the plant to mature.

HARVESTING.

The number of years required for the production of the first cutting of leaves is variable, depending on the size and condition of the suckers when planted, subsequent climatic conditions, and the nature of the soil. Ordinarily the first crop of leaves will mature in three or four years. In Hawaii the first leaves are cut at three years from the time of planting in the field, or four years from the time of setting bulbils in the nursery. The Yucatan heniquen requires from four to seven years to mature the first leaves.

It is customary to harvest maguey once a year, preferably during the dry season. In the wet season the leaves contain a smaller percentage of fiber, and the frequent rains interfere with the work of drying. Each plant should yield from 15 to 30 leaves annually. There is no fixed rule governing the time for cutting the leaves, and this matter is one to be determined largely by judgment and experience. Only those leaves should be cut which incline toward a horizontal position and show signs of maturity. As too much cutting will soon destroy the strongest of plants, constant care should be exercised against overcropping.

The harvesting of sisal in Yucatan is done principally by Indians, who do this work with "corbas," the corba being a bolo having a blade curved at the end. An average day's work is from 1,500 to 2,000 leaves. Following each cutter is a woman, or boy, who cuts off the thorny sides and end spine of the leaves and makes them up into bundles of fifty. These bundles of leaves are carried out to the roads and transported on small tram cars to the cleaning machine.

EXTRACTION OF FIBER.

Maguey leaves should be cleaned within twenty-four hours after they are cut from the plant. If left for a longer period than this the fiber will become discolored at the ends.

An average leaf of maguey is from 4 to 6 feet long, weighs from 1 to 2 pounds, and is about 1 inch thick at the base. It consists of a mass of cellular tissue, through which run the fibro-vascular bundles, or fibers. The work of fiber extraction consists in separating the pulpy portion of the leaf from these fine filaments. There are two general methods by which this end is accomplished. The leaf may be placed in water until the pulp becomes so rotten that it can be easily removed by washing and beating; or, the leaf while still green may be treated to some scraping process that removes the pulp and leaves the cleaned fiber.

The first of these methods, known as "retting," is the way in which maguey fiber is ordinarily cleaned in the Philippine Islands. In the retting process the leaves are first cut from the plant and the thorns and spines are removed. These leaves are then beaten and crushed, or are split into several pieces, and are frequently made up into small bundles. These bundles are placed one upon another in the tide water of some near-by river or creek, where they are allowed to remain from seven to fourteen days, or until the pulp can be easily removed from the fiber. As the leaves at the bottom will ferment more rapidly than those nearer the top, the bundles are turned every few days, but even where the greatest care is taken some of the leaves will be overretted and the fiber weakened. The retting process requires a great deal of time and labor, and results in the production of an inferior quality of fiber. It can only be recommended where the purchase of a fiber-extracting machine is an impossibilty.

The leaf of sisal hemp is practically the same as that of maguey, and can be cleaned by the same methods. Retting, however, has never been generally practiced in the sisal-producing countries. Previous to the invention of a machine for extracting sisal, this fiber was cleaned in Yucatan by a scraping process. Crude, wooden implements, known as the "pacché" and the "tonkas," were used for this work. With these implements one man could clean only from 6 to 9 pounds of fiber daily.

The first machine used for cleaning sisal, which was the "rapasdor," was the invention of a Franciscan friar. This machine is still used to some extent, and all of the improved, automatic fiber-extracting machines that are used to-day for cleaning sisal and maguey are constructed on the same principle and are but improvements of this old machine.

The rapasdor consists of a 54-inch wheel which runs in a heavy wooden case. Across the 6-inch face of this wheel, about 1 foot apart, are placed brass scraping knives. The leaf is inserted through a hole in the case, being held by a clamp, and whips downward as the wheel moves around. A heavy curved block placed underneath is then, by means of a lever, brought to bear on the leaf pressing it against the revolving wheel, which almost instantly crushes and scrapes away the pulp. The leaf is then withdrawn and the other end cleaned in the same manner. Two operators are required for the raspador, one of whom feeds the leaves into the machine while the other operates the lever.

On the sisal plantations the raspador has now been largely superseded by the "Prieto," the "Torroella," and other automatic machines, which clean from 50,000 to 150,000 leaves per day. Where these machines are used, one-half of each day's cutting of leaves is reserved for the following day so that the work of cleaning can commence in the early morning. The leaves are not, however, allowed to accumulate, as after twenty-four hours they begin to harden and are difficult to clean.

In cleaning with the improved automatic machines, the bundles of leaves are first placed on endless carriers, which take them up to the machine platform and drop them on the feed tables. The bundles are then broken and the leaves fed into the grip chains which draw them into the machine. These machines have either two or three scraping wheels, somewhat similar to those of the raspador. On the grip chains the leaf is conveyed to the first scraping wheel, which instantly cleans one-half of it. It is then carried on to the second scraping wheel, and in the case of the three-wheel machines subsequently to the third wheel, which cleans the other half in a similar manner, the cleaned fiber being thrown out at the opposite end of the machine. One machinist is required to attend to the machine, one man to feed it, and two boys receive and handle the fiber.

FIBER-EXTRACTING MACHINERY.

The introduction and the use of fiber-extracting machines is the most vital question affecting the maguey industry. Without such machines the cultivation of maguey is confined to limited areas near the seacoast, where the tide water can be utilized for retting the leaves. The fiber thus produced is inferior in quality, and can never rank with sisal in the markets of the world. The introduction of machinery is, in fact, absolutely essential, if any considerable development of the maguey industry is to take place.

The principal obstacle to the immediate use of the large automatic machines in the Philippine Islands is that few of our maguey planters are in a position either to purchase these machines or to use them to advantage. Maguey has been planted in small and widely scattered fields, and the facilities for transporting a large number of leaves to any one central point are extremely poor. An improved fiber-extracting machine, to be profitably operated, must have such a supply of leaves. There are a few plantations, or localities, that will soon be in a position to use one of these machines, and the number will undoubtedly increase as the industry develops. What is most urgently needed at the present time, however, is a small machine of limited cost, weight, and cleaning capacity, that can be used on the smaller farms.

The old Mexican raspador has been brought into the islands, and has been given numerous trials and experiments. The results obtained have not been entirely satisfactory. The quality of the fiber cleaned by the raspador is excellent, but the amount of fiber obtained is hardly sufficient to justify the cost of operating the machine. The use of the raspador in its present condition can not be recommended. A small machine, the "Pioneer," constructed on the same principle as the raspador but with certain improvements, is soon to be introduced into the Philippine Islands. If this machine does the work that it is claimed to do it should be admirably suited to the present needs of the Philippine maguey planter.

There are a number of different automatic-fiber-extracting machines in quite general use in Yucatan. While each of these machines has its partisans, the "Prieto" appears to be in most general use. Ordinarily these machines do not clean up to their full capacity because of the ignorance of the labor used to operate them. The machines used in Yucatan, and the cost of each, are shown in the following table, prepared by the American consul in Merida:

Hemp-cleaning machines in actual use upon the plantations in Yucatan.

Machine.	Number of leaves cleaned in ten hours.	Number of men needed.	Actual horse-power.	Cost of machine.	
				Mexican currency.[a]	United States currency.
Lanaux reformed	150,000	4	25	$7,000	$3,003
Prieto reformed	150,000	4	16	8,600	3,689
Torroella reformed	100,000	4	16	7,000	3,003
Villamor reformed	100,000	7	16	5,000	2,145
Stephens	150,000	3	70	(b)	(b)
Solis	9,000	3	9	2,000	858

[a] The average value of the Mexican peso in 1902, according to the United States mint, was 42.9 cents.
[b] No more being made.

DRYING AND BALING THE FIBER.

The machine-cleaned maguey fiber of Laoag is washed after it is taken from the machine, and is then dried in the sun. The sisal produced by the Hawaiian Fiber Company is washed as it passes through the machine. In Yucatan the fiber is not washed but is taken from the machine, placed upon small trucks, and carried at once to the drying yards. In the yards the fiber is hung over galvanized-wire racks to dry in the sun. If allowed to remain any length of time after cleaning, without exposure to the sun, it will become dark and spotted. If exposed to rain or dew it loses its luster. On one or two of the Yucatan plantations galvanized-iron piping is now used in place of wire with satisfactory results. In Hawaii the wet fiber is taken from the machine and is laid on the ground to dry. While this method of drying gives a fiber that is straighter and therefore more easily handled in the baling press, its desirability is to be questioned.

When quite dry the fiber is taken to the baling press, in which it should be laid straight without doubling over. On the smaller Yucatan plantations screw presses are used, and on the larger estates hydraulic presses. The weight of the Yucatan bales is variable, ranging from 14 to 16 arrobas, 350 to 400 pounds. The dimensions of a 15-arroba bale are 32 by 25 by 44 inches. Hawaiian sisal is put up in bales weighing 500 pounds, with dimensions of 54 by 30 by 30 inches. The bales are not covered and are tied either with cheap rope or with twisted fiber. Practically all of the Philippine maguey fiber is shipped to Manila and baled on the abaca presses.

YIELD.

The annual yield per acre of maguey fiber will depend upon the number of plants per acre, the number of leaves cut from each plant, the size and weight of these leaves, and the percentage of fiber which they contain. These several factors are so variable, even on a well-organized plantation, that we find the widest variations in the estimates of fiber yield. On two adjoining plantations, where conditions are apparently the same, quite different results may be obtained. The estimates made by authorities and by planters as to the average yield of sisal per acre range from 400 to 1,500 pounds.

The yield of maguey is considerably less than that of sisal. This is due in part to the difference between the Yucatan and the Philippine plant and fiber, and also to the more highly developed system of cultivation of the Yucatan planters. Maguey fiber is finer than sisal, and from a given weight of leaves we get a smaller percentage in weight of fiber than is obtained in Yucatan. With respect to cultivation, the close planting and over-cropping so commonly practiced by our maguey planters result in the production of many small and undeveloped leaves.

In Yucatan it is generally estimated that 82 plants will give an annual yield of 100 pounds of fiber. On this basis, with plants set at 4½ by 12 feet apart, or approximately 800 to the acre, the fiber yield per acre would be 975 pounds. Under average conditions each plant should yield annually from 15 to 30 leaves, giving a total of from 12,000 to 24,000 leaves per acre. The fiber yield is, ordinarily, about 50 pounds per thousand leaves. The fiber yield from 12,000 leaves, at 50 pounds per thousand, is 600 pounds, and from 24,000 leaves, at 50 pounds per thousand, 1,200 pounds, or an average of 900 pounds of fiber per acre.

The following table, showing the results of experiments made by Dr. Charles Richards Dodge in Yucatan, indicates the average weight of leaves and the per cent of fiber which they contain:

Lot.	Age.	Weight, 10 leaves.	Fiber yield.
	Years.	*Pounds.*	*Per cent.*
1	5	20	3.27
2	10	10	5.57
3	10	15½	5.92
4	15	8¾	7.67
5	15	14	5.64
6	30	8	6.87
7	32	15	5.88
8	7	21¼	4.45

The average fiber yield of maguey in the Philippine Islands can not be accurately estimated for the reason that we have no uniform system either of planting or of harvesting. Estimates made by Philippine planters as to the average yield of maguey fiber range from 20 to 40 pounds per thousand leaves. The fiber yield from 12,000 leaves at 20 pounds per thousand is 240 pounds; and from 16,000 leaves at 40 pounds per thousand is 640 pounds, or an average of 440 pounds per acre. In experiments made at the Singalong experiment station in Manila, the average weight of a single mature leaf of Philippine maguey was found to be 28.1 ounces, and the yield of fiber 2.6 per cent. On this basis 1,000 leaves would yield 45.6 pounds of fiber, or 1 acre producing 16,000 leaves would give an annual fiber yield of 730 pounds.

VALUE.

On February 23, 1906, the market quotations in Manila for maguey fiber were as follows: No. 1, ₱15; No. 2, ₱12; No. 3, ₱9, per picul. On December 29, 1905, a sample of maguey fiber, submitted to the firm of Macleod & Co. in Manila, was reported upon as follows:

"The sample of machine-cleaned maguey fiber you left here is very handsome, and I should say of a value equal to sisal, say, 7½ to 7¾ cents, United States currency, f. o. b. New York; or, say, ₱15 in Manila. It might be a little cleaner of wood, or pulp, and the ropy ends are objectionable, but we constantly have the same defects in the Yucatan sisal. This sample is infinitely better than the old salt-water-retted, hand-cleaned Manila maguey. It is not quite as strong as sisal, but finer in texture."

Samples of maguey forwarded to London in October, 1905, were quoted at £30 per ton, the London quotations for sisal on the same date being £37. Machine-cleaned maguey fiber forwarded to fiber brokers in New York City, in 1905, was reported to have approximately the same value as sisal. The usual New York quotations for No. 1, hand-cleaned maguey are from one-half to three-fourths of a cent less per pound than for Yucatan sisal.

The following New York quotations for sisal hemp and for "fair current" Manila indicate the relative value of Manila hemp and good machine-cleaned maguey:

	1902.	1903.	1904.	1905.
Aug. 2:	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Sisal hemp	9¾ to 10	7	7⅛	....
"Fair current" Manila	10½	8	9¼	....
Nov. 1:				
Sisal hemp	8¾	7½	8	....
"Fair current" Manila	10¼	8⅞	9¾	....
Feb. 1:				
Sisal hemp	....	7 to 7¼	7¾	7¾
"Fair current" Manila	....	8¼	9½	10
May 1:				
Sisal hemp	....	9 to 9¼	8½	7⅜
"Fair current" Manila	....	9½	....	9½ to 9⅝

The following table shows the output and value of Yucatan sisal from 1900 to 1905:

Year.	Bales.	Value, Mexican currency.
1900	499,634	$22,616,032.71
1901	517,519	22,783,453.73
1902	528,246	36,432,791.11
1903	590,430	33,481,603.51
1904	606,008	32,022,563.45
1905 to Sept. 1	370,056	18,036,045.19

USES.

The most important use of sisal hemp and maguey in the United States is for the manufacture of binder twine. This fiber is also largely used for tarred lath and fodder yarns, and for other cordage purposes.

In Yucatan and South America sisal is employed for cordage, nets, lines, hammocks, saddlecloths, girdles, bridles, etc. The Yucatan sisal hammocks, made from carefully prepared, hand-cleaned sisal, are remarkably strong and durable.

In the Philippine Islands, particularly in the Visayas, considerable maguey fiber is produced for local use. The young and tender leaves are selected and are cleaned by the scraping process used for cleaning pineapple leaves. The fiber thus obtained is soft and fine, and is used for making delicate handkerchiefs and cloth. Maguey is also used to some extent, in the localities where it is cultivated, for making various kinds of cordage.

UTILIZATION OF WASTE.

A maguey or sisal leaf contains from 2½ to 5 per cent of fiber and from 95 to 97½ per cent of waste. On the Yucatan sisal plantations the fiber-cleaning machines are placed on raised platforms beneath which are small dump cars that catch the waste as it falls from the machine. This waste consists largely of water, which is allowed to run off; the remaining soft, green pulp, and short, broken fiber being run out on the cars to the dump pile.

In Hawaii an attempt is now being made to separate and clean the short fiber that is in the waste, and to utilize this fiber as a filling material for mattresses. The waste fiber is first separated from the pulp with an ordinary pitchfork. It is then steamed to remove the odor, washed, dried in the sun, and passed several times through a picker and cleaner. This process requires so much time and labor that its utility is doubtful.

It has been fully demonstrated that an excellent quality of paper can be manufactured from maguey waste. The principal obstacle to the use of the waste for this purpose is the difficulty and cost of collecting it in sufficient quantity. The use of fiber-extracting machines will result in the production of large quantities of waste where it can be easily and cheaply handled, and will introduce the question of utilizing this waste as a paper-making material.

ENEMIES.

Although the maguey plant seldom suffers any injury from either insect pests or plant diseases, an insect is found in Yucatan, and a fungous disease in the Bahamas, both of which do some little damage on the sisal plantations.

In Yucatan an occasional plant is destroyed by a large black beetle, known as the "max," the life history of which is described by Dr. George F. Gaumer[a] as follows:

"The female insect lays its eggs on the trunk of the henequin plant a few inches above the ground. When hatched the larva burrows into and through the outer bark to the harder fiber of the interior, when it generally takes an upward direction and burrows from 6 to 12 inches during its larval existence. When full grown it works its way to the bark, where it changes to a pupa and so remains for some months, when it hatches into the adult beetle and emerges from the plant, which it leaves injured and weakened, but rarely kills. Three or more larvæ in the same plant will surely destroy it, but that number is of very rare occurrence."

The fungous disease that has appeared in the Bahamas is described by Lyster H. Dewey,[b] botanist in charge of fiber plants, United States Department of Agriculture, as follows:

"When I was in the Bahamas last May, I noticed that there were in a few localities indications of a diseased condition of the sisal plants. I brought back with me some specimens and referred them to the plant pathologist of the Bureau of Plant Industry, who reported the presence of a fungus on the leaves, but that it was not in a condition for determination. Recently I have received from one of the principal growers in the Bahamas a letter stating that, while the diseased condition seems to be confined to small areas, it is slowly spreading and causing some alarm lest it may prove destructive.

"The symtoms are described as follows:

"Yellowish spots or patches are first observed on the leaves. These spots spread. The leaf gets dry and curls, usually half way down from the point; the edge of the leaf becomes pinkish in color. In a week or two, sometimes longer, the leaf dries and becomes black and hard. Usually the upper half of the leaf is affected, the lower half remaining green much longer. Sometimes the funnel, as it is called in the Bahamas, consisting of the unopened leaves, is attacked at the tip. The disease usually affects only 5 or 6 inches of the upper part of the funnel, but sometimes extends clear to the base.

"This condition has not been observed in the Bahamas until within the past year. It may have existed there before, but to so small an extent as to be regarded of no importance.

"I would suggest that the sisal growers of the islands be warned in regard to the possible introduction of such a disease, and that they be urged to go through their plantations, and, if any sisal plants are found exhibiting symptoms of the character described, they should be grubbed out and destroyed."

The above suggestion, given to the sisal growers of Hawaii, is equally applicable to the maguey planters of the Philippine Islands. Plantations should be watched for the appearance of either injurious insects or fungous diseases, as these enemies are much more easily checked in the beginning than after they have become numerous and widespread.

The maguey plant is not affected by hot weather nor killed by drought. An exceptionally long period of dry weather may slightly check its growth, but will not seriously injure the plant. Its greatest enemy is fire. Where a large quantity of dry rubbish is allowed to collect in the field, and particularly around the plants, there is always danger of fire. If, under these conditions, a fire is once started, it may cause a total loss of the crop.

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[a] E. H. Thompson, United States Consular Report, No. 1582, 1903.

[b] Bulletin Hawaii Agricultural Experiment Station, Honolulu, 1903.

SUMMARY.

In certain parts of the Philippine Islands there are large areas—in some cases practically entire provinces or islands, as Bohol, Sequijor, and Mactan—where the land is too dry or the soil too poor for the cultivation of any one of our well-known staple crops. In these sections the great majority of the farmers are without animals and without capital with which to purchase machinery and hire labor. Where these conditions exist there is urgent need for the introduction of some plant that can be profitably grown.

Maguey not only answers all these requirements but also yields returns which compare favorably with those of crops grown under much more favorable conditions. That maguey is suited to conditions found in the Philippine Islands and that it is favorably regarded by Philippine planters is indicated by the fact that our exports of this fiber have increased 115 per cent in four years.

The maguey plant is found in nearly all parts of the archipelago. Its more extensive cultivation requires only a more general knowledge of the details of the industry and better facilities for cleaning the fiber. The importation of one fiber-cleaning machine has greatly increased the output of fiber in the province where this machine is now in operation and has awakened among our maguey planters an interest that will lead to the importation of other machines.

The establishment of the maguey industry on a thoroughly satisfactory basis requires, primarily, three distinct lines of improvement, viz, an improved system of planting, an improved system of harvesting, and the introduction of fiber-extracting machines. The selection of suckers from our largest and best plants and the introduction of sisal from Hawaii and Yucatan should result in an improvement in quality and an increase in yield of our Philippine fiber. Planting in rows and with plants a greater distance apart will lessen the cost of cultivation and will give more and better fiber. Careful cropping, or the cutting of only mature leaves, will improve the quality of the fiber and will lengthen the life of the plant.

The cultivation of maguey offers inducements to the small farmer and to the planter with large estates. While the future price of maguey fiber, as of any other agricultural product, can not be predicted with any degree of certainty, this fiber is a staple commodity the use of which promises to increase quite as rapidly as does its production.

The growth of the maguey industry in the Philippine Islands during the past four years indicates that this fiber will at no distant date become one of our important agricultural products.

BUREAU OF AGRICULTURE.

(Press Bulletin No. 1.)

MAGUEY CULTIVATION IN MEXICO, 1904.

INTRODUCTION.

This valuable plant, while known for many years, has been cultivated in this Republic for only a short time, and has since then developed into a very important agricultural and commercial product.

The maguey plant, also called "century," "yaxci," or "henequin," is a species of the genus *Agave*. The fiber after being extracted is generally known as sisal, ixtle, or henequin. This fiber is mostly shipped to the United States, where it is manufactured into sacking, cordage, and binder twine, the finer qualities being used for making fancy hammocks and other similar articles.

The maguey which is grown in the State of Yucatan is considered more valuable than that grown in other States of this Republic. The leaves are longer than those produced in other sections, and the Yucatan sisal, because of its length, whiteness, and strength, will bring, if packed separately, a much better price than that produced elsewhere.

Yucatan leads all the States of Mexico in the production of the maguey plant. This new enterprise is making this State one of the wealthiest in the Republic, and it is outstripping any similar industry in point of rapid increase.

Progreso, the port from which nearly all the ixtle for export from Yucatan is shipped, shows the exportation for the fiscal year 1901, as per consular reports, to amount to $8,110,571.60 United States gold, and for the fiscal year 1902, $12 802,655.21, being an increase of more than 50 per cent over the preceding year.

Monterey, Saltillo, Tampico, San Luis Potosi, Ciudad Porfirio Diaz, and Mazatlan all export this fiber. Each year shows a handsome increase. The estimated export from this Republic for the year will reach over 20 millions. The official export of ixtle fiber, as published by the Mexican Journal of Commerce under date of August 1, 1903, from all ports of the Republic for the fiscal year 1902 amounted to $14,188,129, and for the same period of 1903, $17,261,069.50.

CULTIVATION.

The maguey plant is found in its wild state in many of the States of Mexico. It thrives on poor, rocky lands, where scarcely anything else will grow. The climatic conditions of Mexico are very favorable for the cultivation of maguey. Especially is this true near the coast, as here the ranges of mountains form a protection for the young plants. Once planted and thriving, they will produce crops for many years. Age will give them additional value, as when the leaves grow larger and longer the fiber extracted will gain in fineness and strength. The life of the plant is from eight to twenty years, depending on the species and the local conditions. Great care should be taken in the selection of the young shoots for transplanting. These sprout from the old stock and are ready for transplanting when about 15 inches high. The best time for transplanting is immediately before the commencement of the rainy season, which begins here in July and ends in October. The young plants should be set out in straight rows, and should be not less than 3 feet apart.

No special care or cultivation is required, though occasional irrigation is beneficial It is necessary also to cut and destroy all large weeds. When the plant is from 3 to 4 years old the longest leaves can be cut. The cutting is done close to the trunk, the horny ends are removed, and the leaves are then ready for the cleaning machine. The maguey plant is very hardy, and survives and increases where almost any other vegetation would fail. After being well rooted it can endure long periods of drought and will stand any amount of hot weather. Great care should be taken that the plants do not catch fire, as a fire once started in a maguey plantation is very difficult to check. No smoking by laborers should be allowed. The maguey plant is best propagated from cuttings or suckers. These cuttings, if properly packed, can be shipped long distances and will arrive in good condition.

EXTRACTION OF FIBER.

A machine for the extraction of maguey fiber, which is in general use and which gives very good satisfaction, is manufactured in Mazatlan. This machine weighs 850 kilos, and costs, ready for shipment, $350, Mexican, and with cap or cover $450. It will strip about 7,000 leaves in a day of ten hours, which should yield 14 arrobas of fiber. Presses for baling maguey are also manufactured in Mazatlan. These presses weigh 850 pounds and cost $200, Mexican. For use on large plantations, machines known as the "Prieto Automatic Machine" and the "La Estrella" are manufactured in Paterson, N. J. These machines will strip 60,000 leaves daily, and cost $2,000 gold.

USES OF THE PLANT AND FIBER.

The green, fleshy portion of the leaf, when stripped off from the fiber, furnishes a valuable feed for cattle and hogs. This material is very fattening, and is much relished by the animals.

The residue of the leaves, after the fiber has been extracted, is used for making mescal or tiquile, a favorite native drink. This waste material is first put in a press, and all of the juice which it contains is pressed out. This juice is then put in a double-bottomed copper kettle and thoroughly boiled. It is then allowed to ferment, and whatever scum that appears is removed. The retail price for mescal is from $1 to $1.50, Mexican, per gallon, and the cost of production is from 35 to 40 cents per gallon. The dry material left, after the leaves have been pressed, may be fed to cattle and hogs.

The stem, after the leaves have been removed, is cut close to the ground, placed in a mill, and mashed to a pulp between stones. This pulp is transferred to wooden tubs, mixed with water, and allowed to ferment for six days. After the expiration of this time the whole mass is placed in a copper kettle and, either by steam or direct fire, is thoroughly boiled. From this material alcohol is made which costs to produce about 50 cents and which sells at wholesale for about 85 cents per gallon.

Rope and twine are manufactured from the maguey fiber by the natives. Little or no machinery is used for this work. A ready market is found for the rope made by the natives. It is sold locally, and none is exported.

DISPOSITION OF FIBER AND PROFITS.

The sisal fiber of Yucatan and the neighboring States is nearly all shipped to New York. The fiber produced in Sinaloa is shipped to San Francisco, where there is always a good demand for sisal. The average price in San Francisco has been $140 gold per ton, while in New York the average price has exceeded $200 per ton. There has at all times been a ready market for the fiber.

The cost of production, including all expenses, ready for shipment, will not exceed $75 gold per ton, leaving a net profit of over 100 per cent, and making the cultivation of the maguey plant one of the most profitable industries of this Republic.

H. T. Edwards,
Fiber Expert, Bureau of Agriculture.

BUREAU OF AGRICULTURE.

(Press Bulletin No. 8.)

1. MAGUEY—2. PROPAGATING ABACÁ FROM SEED—3. PHILIPPINE EXHIBIT FOR THE PACIFIC COMMERCIAL MUSEUM—4. MISCELLANEOUS NOTES, 1906.

MAGUEY.

The cultivation of maguey in the Philippine Islands is, at the present time, attracting very widespread attention. In those provinces from which maguey has been exported for a number of years larger areas are now being planted. In other sections where this plant has been either unknown or unnoticed it is now being introduced. Numerous requests for information as to the essential details regarding this plant and its cultivation have been received by the bureau of agriculture. In order to supply this information in as brief and simple a form as possible the following circular, printed in English, Spanish, Tagalog, Visayan, and Ilocano has been issued.

MAGUEY.

1. What is maguey?

Answer. Maguey is a plant having a short, thick stem which bears a large cluster of green, spiny leaves. These leaves yield a valuable fiber that is used in all parts of the world for making rope and twine.

2. Why should maguey be planted in the Philippine Islands?

Ans. This plant flourishes through the long dry season; it can be cultivated on poor, rocky or sandy soils where no other crop can be grown; it can be cultivated without the use of carabaos or other draft animals; it is not injured by locusts or other insects; it requires but little care and attention; and it is a good paying crop.

3. In what provinces can maguey be grown?

Ans. Maguey can be profitably grown in any province in the Philippine Islands. The conditions are particularly favorable in Ilocos Norte, Ilocos Sur, Union, Zambales, Cebu, Bohol, and Siquijor.

4. How is a maguey plantation started?

Ans. A maguey plantation is started by setting out either the suckers which grow from the roots of the old plants, or the small bulbs which are produced on the flower stalk.

5. Where can these suckers and bulbs be obtained?

Ans. They can be obtained in small quantities in nearly every province from farmers who already have maguey. Suckers or bulbs of sisal hemp, which is a superior variety of maguey, can be purchased in the Hawaiian Islands. Information as to where maguey and sisal suckers can be secured will be furnished by the bureau of agriculture in Manila.

6. When should maguey be planted?

Ans. During the rainy season.

7. On what kind of land should maguey be planted?

Ans. Maguey should be planted on hillsides or on land that is well drained. It can be planted in dry, sandy soils, and it will grow particularly well in soils containing coral rock. It should *not* be planted on low level, paddy land where water will stand during the rainy season.

8. How should maguey be planted?

Ans. Maguey should be planted in rows 12 feet apart, with the plants 4½ feet apart in the row. This system will give larger plants, larger leaves, better fiber, and more fiber per hectare than the present Philippine method of setting out plants but 2 or 3 feet apart.

9. How is maguey cultivated?

Ans. Maguey requires but little cultivation. Two or three times a year the fields should be cleaned of weeds and grass, and the suckers which grow from the roots of the old plants should be cut out.

10. How long after planting can the first leaves be cut?

Ans. In three years where suckers are planted and in four years where bulbs are planted.

11. How many leaves should be cut at one time?

Ans. Only one or two rows of the large, mature leaves around the base of the plant should be cut at one time. The Philippine system of cutting at one time nearly all the leaves on the plant is utterly wrong. This system weakens the plant, reduces the yield of fiber, and produces an inferior quality of fiber. *Cutting only the mature leaves will do more than any other one thing to improve the present condition of the maguey industry.*

12. How is the fiber extracted?

Ans. In the Philippine Islands maguey fiber is extracted by rotting the leaves in salt water. The leaves are left in the water for a few days and the pulp is then beaten and washed away, leaving the clean fiber. The fiber is then laid on the ground, or is hung over bamboo poles, and dried in the sun. This system of rotting, or "retting," as it is called, is very unsatisfactory and produces a poor quality of fiber.

13. What machines are used for cleaning maguey?

Ans. Large machines which clean from 50,000 to 150,000 leaves per day, and cost from ₱6,000 to ₱9,000 are used in Mexico. A smaller machine which cleans 15,000 leaves per day, and costs ₱2,000, is manufactured in New York. Arrangements are now being made by the bureau of agriculture to bring one of these smaller machines to the Philippine Islands and to operate it in the different provinces.

14. What is the yield of fiber?

Ans. One plant will yield from 15 to 30 leaves per year. Where only the large, mature leaves are cut the yield of fiber will be from 30 to 40 pounds per 1,000 leaves. With plants set out 12 by 4½ feet apart, or approximately 2,000 to the hectare, the annual yield of leaves per hectare is from 30,000 to 60,000 and of fiber from 900 to 2,400 pounds.

15. What is the value of maguey fiber?

Ans. The current Manila quotations for maguey are as follows: No. 1, ₱15; No. 2, ₱12; No. 3, ₱9. Good machine-cleaned maguey fiber is equal in value to good sisal, which is worth only 1 to 2 cents less per pound than abacá.

16. What are the prospects for maguey in the Philippine Islands?

Ans. The production of maguey in the Philippine Islands has more than doubled during the past four years, and it is being more extensively planted every year. There is practically no limit to the area in the islands that is suitable for this crop. Thousands of hectares of what is now waste land would grow good maguey. Thousands of hectares of poor, stony land now producing miserable crops of corn and tobacco should be planted to maguey.

Certain improvements are urgently required. The more careful selection of suckers for planting; an improved system of planting; cutting only the mature leaves; and the introduction of fiber-extracting machines will give us more and better fiber.

In Yucatan, where conditions of soil and climate are very similar to those found in parts of the Philippine Islands, more than ₱30,000,000 worth of sisal is produced every year. Maguey now ranks fifth among our exported products and is exceeded in value only by abacá, copra, sugar, and tobacco. There is every indication that with the introduction of improved methods the cultivation of maguey will become one of the leading industries of the Philippine Islands.

PROPAGATING ABACÁ FROM SEED.

The ordinary method of starting a new abacá plantation or of enlarging a plantation already established is to set out either suckers or root sections taken from mature plants. Abacá may be propagated by these two methods and also by the use of seed. The advantages of using suckers and root sections rather than seed are that the plants mature from six months to one year earlier and the planter is saved the trouble of establishing and caring for a nursery. Where an abundant supply of suckers can be secured at a reasonable cost from nearby plantations, there is little to be gained by the use of seed.

Unfortunately, however, the above conditions do not always exist. A new plantation may be established in a location more or less remote from any other plantation which will necessitate the transportation of suckers a long distance, or the number of new plantations in one locality may be such as to more than exhaust the available supply of suckers. Both of these situations have been forcibly illustrated in the district of Davao, in Mindanao, during the past two years. A number of the American planters in Davao have experienced great difficulty in securing a sufficient supply of suckers for planting their newly cleared fields. Where such a shortage exists, a planter is obliged to spend considerable time hunting up suckers for which he pays an excessive price, and still more time and money are expended in transporting these suckers from distant plantations.

These facts lead to the natural conclusion that while the use of seed exclusively is not to be recommended, it may be valuable in connection with other methods. If suckers are used for the first planting and at the same time a nursery is established, the planter will have the second year a supply of plants for replenishing and extending his plantation.

The quantity of seed required can usually be secured from any old plantation. The fruit from which seed is to be taken should be gathered before it is overripe and dried. The following methods of planting have been recommended by abacá planters:

"Two days before sowing two or three racemes of those which first sprouted from the fruit are removed therefrom, soaked in water over night, and on the following day placed in the shade. On the third day they are sown in holes 1 inch deep at intervals of one palm in high, shady land. A year after the seed has been sown the small plants are of sufficient height and consistency to be treated exactly as if they were shoots or sprouts.

"The seeds of the ripe fruit are extracted and well washed to remove the pulp and are then dried. The seed bed is prepared in clean, well-fertilized soil. Before the seeds are planted they are placed in a bucket of water for five hours. Only the seeds which sink to the bottom are used. The seeds are sown broadcast and are covered with a brush harrow. In one year the young plants may be transplanted.

"Two days before sowing the kernels are removed and steeped in water over night. The next day they are dried in a shady place, and on the following day are sown in holes 1 inch deep in fresh, unbroken, and well-shaded forest land, allowing 6 inches between the plants and between the rows. After a year the seedlings, then about 2 feet high, are planted out and tended in the same way as suckers."

A small nursery can be established on any plantation at comparatively little expense. While such a nursery may not always be required it will, in many cases, far more than pay for the trouble and cost of its maintenance.

PHILIPPINE EXHIBIT FOR THE PACIFIC COMMERCIAL MUSEUM.

An exhibit of the agricultural products of the Philippine Islands, and of certian articles and materials made from these products, is now being collected by the bureau of agriculture. This exhibit, when complete, will be forwarded to San Francisco and placed in the Pacific Commercial Museum.

The principal objects in view in preparing this exhibit are to stimulate the demand for those products which the Philippine Islands have for sale, and to attract American capital to the islands. The number of Philippine products for which there is now any considerable demand is comparatively small. We produce, however, numerous other raw materials and manufactured articles which compare favorably with similar materials and articles now imported into the United States from other countries. Our kapok, or tree-cotton fiber, which is largely allowed to go to waste, the United States imports from Java. The finer grades of Philippine hats would find ready sale in many parts of the United States. Our jusi and piña textiles are admired in all parts of the civilized world. If we are to develop our export trade in these and other articles, it is essential that the prospective buyers of our products shall have an opportunity to see and know what we have to sell.

The desirability of attracting to the islands capital which shall develop our agricultural resources is too generally understood to require comment. In order to accomplish this end, we can do no better work than to send the capitalist, through a commercial museum, an exhibit of our products.

The exhibit which is now being prepared will include our staple exports, abacá, copra, sugar, tobacco, and maguey; a collection of the more important fibers of the islands, and the articles manufactured from these fibers; the native fruits, vegetables, and general farm products, and such other worthy things as can be secured.

In order to make this exhibit a success, it should represent the entire archipelago, and all of our leading industries. Every province in the Philippine Islands has some product or products which it desires to sell. In this Pacific Commercial Museum exhibit we have an opportunity to show these products to the outside world.

An invitation has been, and is again, extended to each province, and to each commercial house or individual who is interested in the development of the islands, to cooperate in this work.

MISCELLANEOUS NOTES.

During the past two months 100,000 plants of sisal hemp have been received from the Hawaiian Islands. These plants have been distributed in twenty-three provinces, and have been universally received with great favor. More than 400 requests have been made for these plants, and many of the provinces to which they have been sent have asked for larger allotments. A second shipment of 100,000 plants, which will also be distributed in the provinces, is expected in October. Requests for these plants should be sent as soon as possible to the bureau of agriculture.

In a communication recently received from a paper manufacturer in New York City, the following statement is made concerning abacá waste.

"If this waste hemp can be utilized for paper making, it will be nothing more nor less than a godsend to the manufacturers of rope paper in the United States, who are altogether dependent upon old rope for paper-making purposes. The price of this old rope has now reached 4½ cents per pound, which is the highest price it has reached in recent years, and the writer can see no reason why it will not inevitably go much higher. Several industries are dependent upon the supply of rope paper, and at present there is nothing, except possibly this waste Manila hemp, that can be used as a substitute."

It has been thoroughly demonstrated that abacá waste answers every requirement of the paper manufacturer. With the advance in price of old rope, the outlook for the utilization of the waste is most promising.

BULLETINS

ON

GUTTA-PERCHA AND RUBBER

IN THE

PHILIPPINE ISLANDS.

BUREAU OF GOVERNMENT LABORATORIES.

(Bulletin No. 7.)

THE GUTTA-PERCHA AND RUBBER OF THE PHILIPPINE ISLANDS.[a]

By Penoyer L. Sherman, Jr., Ph. D.

LETTER OF TRANSMITTAL.

Department of the Interior,
Bureau of Government Laboratories,
Manila, P. I., September 20, 1903.

Sir: I have the honor herewith to transmit for publication as a bulletin a monograph on the gutta-percha and rubber of the Philippine Islands, by Penoyer L. Sherman, jr., Ph. D., chemist in the bureau of government laboratories.

I am, very respectfully,

Paul C. Freer,
Superintendent Government Laboratories.

Hon. James F. Smith,
Acting Secretary of the Interior.

INTRODUCTION.

The material for this bulletin was collected under the direction of the bureau of forestry and of the bureau of government laboratories. As early as 1900 the attention of the government was called to the fact that many of the wild tribes in the southern islands were engaged in cutting down large numbers of forest trees in order to secure the gutta-percha and rubber which they contained. These products they bartered to the Chinese, who in turn exported them to Singapore.

The matter was considered important enough to demand investigation, because—

(1) The trees were being cut down in violation of forestry rules.

(2) No forestry dues were paid by those either collecting or exporting these forest products.

(3) Judging from the experience of the English and Dutch in the Malay Peninsula, Sumatra, and Borneo, it would only be a question of a short time, if the wild tribes were allowed to have their own way, when there would not be one tree of this class left standing in the Philippines.

Unfortunately there was no information at hand on the subject. In June, 1901, I was sent as a special agent of the forestry bureau to Singapore, the Malay Federated States, and Java to study the laws and conditions under which these forest products were grown, collected, and marketed.

Provided with the information thus gathered and which is detailed below, upon my return to Manila, four months later, I was again sent to the southern Philippines to repeat my investigations and, as before, to make collections of herbarium material and samples of the various kinds and grades of gutta-percha and rubber found there.

This first southern trip consumed several months, for, while specimens of marketable gutta-percha and rubber could be secured in the principal towns, all herbarium material and gums from each tree species had to be taken personally to avoid all sources of error.

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[a] The illustrations mentioned herein have been omitted and are on file in the War Department.

The trips along the coasts and rivers of many of the islands were made in small native sail and row boats, and the journeys into the forests of the interior were completed on foot with native guides and carriers. The native gum collectors themselves, their method of felling the trees and vines, securing the gutta-percha and rubber, preparing the same for market, the prices they received both in money and barter were thus seen at first hand, and of course opportunity secured for making herbarium collections of the various species of trees and vines yielding gutta-percha and rubber. In the principal towns the market conditions of supply, demand, prices, etc., were studied.

Upon my return to Manila I was ordered to be transferred to the bureau of government laboratories, in order that all specimens collected might be tested chemically and physically so as to determine their relative values. This analytical work, as well as several subsequent trips to the southern islands, Paragua, Mindoro, and Culion in search of new material, has been carried out and is here reported.

The identification of the various species of gutta-percha and rubber trees and vines was kindly undertaken by Mr. E. D. Merrill, botanist for the bureau, who also assisted greatly in collecting herbarium material in Mindoro and Culion.

My thanks are also due to Messrs. J. H. Thigpen and Paul Stangl for much assistance in the analytical work. To Capt. George P. Ahern, chief of the forestry bureau, and Dr. Paul C. Freer, superintendent of government laboratories, I wish to express warm appreciation of their many courtesies and valuable suggestions in planning and carrying out the work.

PART I.—GUTTA-PERCHA.

I. HISTORICAL.

As is the case with many other commercial products coming from oriental lands, the date of the discovery of gutta-percha is lost in oriental history. The famous Tradescant Brothers in 1656 (1) exhibited in their museum of curiosities in London a piece of gutta-percha which they had secured in the Far East. Also in 1822 Dr. William Montgomery (2), an English surgeon, saw whips and other articles of gutta-percha in use by the natives of Singapore. It is therefore safe to assume that the real discovery of this remarkable substance was made at some time previous to either of these dates.

The western or commercial discovery of gutta-percha was delayed until 1843, when both Doctors Montgomery and D'Almeide sent specimens of the gum and leaves of the tree to London. While the specimens of D'Almeide were neglected, those of Montgomery received enough attention from the scientists of the Royal Society of Arts to demonstrate some of the uses to which the substance might be put. The botanists agreed that the tree belonged to the family *Sapotaceæ*, but as neither flowers nor fruit were at hand they could go no further with the identification.

In 1847 the greatest advance was made toward the utilization of gutta-percha. Considerable amounts had from time to time been shipped to London, and experiments were made to determine its physical and chemical characteristics. Luckily a sample fell into the hands of a young German artillery lieutenant, Werner von Siemens, who was then experimenting with insulating material for subterranean and submarine telegraphic cables (3). The ease with which gutta-percha lent itself to this object and the high efficiency obtained induced him to construct a machine for insulating cables. The methods he adopted, as well as the kind of machinery, have been, with few modifications, in use ever since.

The subsequent history of gutta-percha runs parallel with that of submarine and subterranean electric cables, for three-fourths of all the gutta-percha produced has been used on them. With the construction of the great trans-Atlantic cables in the sixties and seventies of the past century, the demand for gutta-percha became enormous, and the details of its value and ready market traveled over all this part of the Orient.

When the Malay Peninsula adjacent to Singapore failed to supply sufficient quantities to meet the demand, the adjacent islands of the Rhio Archipelago and Sumatra were invaded and rich finds made. Finally Borneo was included in the producing zone, and lastly the Philippines.

At what date the Philippines began to export gutta-percha to Singapore, the center of the trade, can not be learned with any degree of certainty. Probably twenty years ago varying quantities were exported, but apparently the trade died out, owing, it is said, to the wholesale adulterations practiced by the Chinese exporters and the prohibitory laws of the Spanish Government. For the last ten years prior to the American occupation of the islands but little had been shipped, though the collecting and exporting began very soon afterwards and increased at once to large proportions.

II. BOTANICAL.

In the year in which Von Siemens made his great discovery of the insulating value of gutta-percha for submarine cables Sir Joseph Hooker, Bentham, and others worked out the status of the gutta-percha tree. From the first specimen of leaves which had been sent to England several years previously it was seen that the tree belonged to the natural family of *Sapotaceæ* (4). The many species of this family are scattered over the tropical and semitropical world and are distinguished by the curious property all possess of secreting a milk or latex in the inner layers of the bark. When the bark is cut or bruised and the capillary sacks and tubes which contain the latex are ruptured it flows out with greater or less abundance according to the species of the tree. This milk probably serves in the plant economy as a protection; still it is primarily an execretion, since it is discarded by the tree in its dead leaves and bark and the bark of the live tree can be tapped and the latex removed with no apparent injury to the tree.

As has been stated, it was in 1847 that specimens of the flowers and fruit finally reached London and the complete botanical determination of them made, which resulted in giving to the tree the name of *Dichopsis gutta* Benth. et Hook., fils. A few years later the Dutch botanist Burck pointed out the fact that as early as 1837 Padre Blanco (5) had given the name of *Palaquium* to this genus of *Sapotaceæ*, and accordingly most botanists have adopted the generic name *Palaquium* for these wonderful species[a] of forest trees which produce the bulk of all the gutta-percha of commerce.

As the demand for gutta increased and the trees of the species *Pal. gutta* became scarcer and more difficult to reach, the native collectors were not slow in finding other species that produced gutta-percha, though of an inferior quality. Among these *Pal. treubii* Burck, *Payena leerii* Benth. et Hook, fils, and *Mimusops balata* Gaertner, fils, are the best known. Many other species have been found in Sumatra, Borneo, Celebes, and the Malay Peninsula, but what part they play in the production of the gutta-percha of commerce has not yet been determined.

The accompanying figures will show some of the resemblances and differences between the species above mentioned. The trees of the genus *Palaquium* are among the largest of the tropical forest and are generally to be noted by the brilliant green color of their leaves above and the golden to copper-brown shimmer below.

The following general description of the botanical characteristics of *Palaquium* is made by Mr. Merrill:

PALAQUIUM, BLANCO 1837 (DICHOPSIS THWAITES).

Usually large trees with rusty tomentose branchlets. Leaves obovate or oblong, acute or obtuse, petioled, coriaceous, glabrous beneath, or densely rusty tomentose. Flowers fascicled, axillary on the naked branches below the terminal leaves. Calyx lobes 6, in two series, corolla lobes 6. Stamens 12 to 18, attached near the base of the corolla. Ovary 6-celled. Fruit fleshy, ellipsoid or ovoid, 1 to 2 seeded. Seeds exalbuminous, cotyledons large, fleshy.

In regard to the species *Mimusops balata* mentioned above, it is to be noted that it is the only representative so far known of gutta-percha producing trees in the Western Hemisphere. It was discovered in the Guianas in 1857 and contains a fairly good grade of gutta-percha. Obach (6) designates it in his description as a substitute for gutta-percha in all its chemical and physical characteristics. Though of an inferior grade to that coming from *Palaquium gutta*, it may well be classed among the rest of the *Palaquium* and *Payena* species furnishing second and third grade gutta-percha.

The gutta-percha trees of the Philippines embrace both *Palaquium* and *Payena* species, and while their complete determination or identification is still unfinished, those which produce the gutta-percha of commerce have been located, and their final identification is only a matter of collecting more complete herbarium material.

The following table (No. 1) gives the species at present known. Those marked (*) probably furnish the largest part of the gutta-percha exported from the southern islands:

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[a] Of late years the Dutch and English botanists in the Orient have been inclined to divide *Pal. gutta*, the most valuable of the gutta-percha producing species, into three species, viz, *Pal. gutta*, *Pal. oblongifolium*, and *Pal. borneense*, but as no certainty of differentiation yet exists, while the gutta-percha from all is the same, they may for the present be all classed under *Pal. gutta*.

TABLE NO. 1.—*Present known species of gutta-percha.*

Species.	Local name.	Locality.	Botanical description.
Leaves rusty tomentose beneath:			
Pal. latifolium Blanco.	Palacpalac or Alacap.	Luzon to Mindanao.	Leaves obovate, obtuse, 10 to 30 cm. long, 5 to 15 cm. wide; nerves, about 15 pairs.
Pal. oleiferum Blanco.	Alacap or Baracan.	Luzon	Leaves obovate-lanceolate, 10 to 25 cm. long, 6 to 10 cm. wide, acute; nerves, about 15 pairs; closely related to the preceding.
Pal. barnesii Merrill.	Nato	Masbate	Leaves obovate, obtuse, thin, 12 to 15 cm. long, 7 to 8 cm. wide; nerves, 11 pairs.
*Pal. ahernianum Merrill.	Calapia	Mindanao	Leaves ovate or obovate, obtuse or acute, 12 to 14 cm. long, 5 to 6 cm. wide; nerves, 15 pairs.
Leaves glabrous beneath:			
*Pal.celebicum Burck.	do	do	Leaves lanceolate, acute, 15 to 20 cm. long, 5 to 6 cm. wide; nerves, 12 to 14 pairs.
Pal. cuneatum Vidal.	Dulitan	Luzon	Leaves ovate, lanceolate or obovate, acute or obtuse, 5 to 7 cm. long, 2 to 3 cm. wide; nerves, 11 to 12 pairs, indistinct.
Pal. gigantifolium Merrill.		Tayabas	Leaves obovate, 50 cm. long, 20 cm. wide; nerves 20 to 24 pairs.
Pal. luzoniense Vidal.	Bagalañgit	Luzon	Leaves ovate, acute or obtuse, 10 to 14 cm. long 4 to 6 cm. wide; nerves, 12 pairs.
*Pal. mindanaense Merrill.	Calapia	Mindanao	Leaves ovate, acute, 9 to 12 cm. long, 4 to 5 cm. wide; petioles 3 cm. long; nerves, 14 to 16 pairs.
*Payena leerii Benth. and Hook.	do	Tawi-Tawi	Leaves ovate or ovate oblong, 5 to 10 cm. long, 2.5 to 4 cm. wide, cuneate at the base; short acuminate at the apex.

III. GEOGRAPHIC DISTRIBUTION.

As previously stated, the first gutta-percha trees were reported from the island of Singapore, and in fact within a few miles of the city itself. When the substance became a marketable article these trees were the first to fall and all of the island was soon devastated. The explorations from Singapore as a center were made in all directions and with remarkable success. All of the forest of the southern half of the Malay Peninsula gave large yields, as well as the islands of the Rhio Archipelago, Borneo, and most of Sumatra. However, from all of the data which have been gathered from native sources, as well as from the information collected by many Dutch, English, and French explorers, it appears that the area of distribution of *Palaquium gutta* is sharply defined. Beyond the sixth degree north on the Malay Peninsula the trees become scarce or cease altogether; on the northern end of Sumatra they are likewise lacking. Java, bordering close on Sumatra, contains none, and Celebes to the east of Borneo has been found to be equally destitute. Reference to map (No. 1) will show the area of distribution of the *Palaquium gutta*, which is practically included in a parallelogram inclosing the above-mentioned peninsula and islands. This area includes some 450,000 square miles of land, of which only a very small per cent is or ever was covered by gutta-percha trees.

Obach ,in his celebrated book on gutta-percha, practically limits the area of gutta-percha production for the entire world to this small territory (7). While this statement is probably true so far as the gutta-percha from *Palaquium gutta* is concerned, we have already seen that the area of distribution of the other or inferior species is extended eastward so as to take in the Philippines, and the same is also true of Celebes, Java, and the northern half of the Malay Paninsula.

The number of gutta-percha producing species in the Philippines has already been listed, and some of the localities given where they have been found. Attention is again called to the distribution of these localities, extending so far north as well as south, and it can be confidently expected that when the forest surveys are completed nearly all of the islands will be found to contain some species in more or less abundance.

Owing to the limited extent of the areas where gutta-percha trees have so far been found on most of the islands, the regions which produce gutta-percha for the market at the present time are confined to the islands of Mindanao and Tawi-Tawi. The accompanying map (No. 2) is arranged to show the places where gutta-percha species have been found as well as to give some idea of the size of the districts producing the gutta-percha now being exported. The exact or even approximate extent of these areas is difficult to calculate. Much has not yet been explored, and the information derived from the natives is vague and contradictory. The areas on the map are given conservatively and are known to produce gutta-percha at the present time. Other territories will probably become known as our intercourse with the wild tribes inhabiting these regions grows more friendly and open.

List of towns and forest regions from which gutta-percha is exported to Singapore.

Central point for collection and exportation of gutta-percha.	Point of collection of gutta-percha from the various forest regions.	Name of forest regions from which gutta-percha is collected.
Cotabato	Tukuran and Dinas	Dinas-Subano Camalarang, Labangas, Tukuran.
	Malabang	Laguna de Lanao, Baras, Liangan, Segayan.
	Clan, Sarangani, and Binang	Tagabuli, Manobo, Bilan, Binang.
	Reina Regente and Salaya	Dama Balao, Matingauanan, Talayan.
Zamboanga	Baluan, Curuan, Talucsangi, Puerta Santa Maria, Dapitan, Misamis.	Western and northern Subano.
Jolo (Sulu)	Transshipped from Davao, Cotabato, Zamboanga, or Siassi.	Tawi-Tawi.
Bongao	Siassi, Balambing, Buan, Dajapatan.	Do.

The islands of Paragua (Palawan) and Balabac were found destitute of either gutta-percha or rubber producing trees, although long and careful search was made for them in many localities. Owing to their close proximity to Borneo, and the fact that botanically and geologically these islands are supposed to be more closely allied to Borneo than to the rest of the Philippines, it was confidently expected that both gutta-percha and rubber would be found there. The absence of these forest products is probably due to the uneven distribution of the rainfall with a long drought in January, February, and March.

IV. METHODS OF COLLECTING AND MARKETING.

(A) COLLECTING.

The question for what is the best method for collecting gutta-percha has troubled owners and dealers from the beginning, and a satisfactory answer is still lacking. The trees are in the tropical forest regions of the Malay Archipelago, Borneo, and the Philippines, which are inhabited by the wildest pagan tribes only. These natives are the natural gutta-percha collectors and as a matter of fact have done all the collecting since the beginning. They evolved a method which answered their requirements very satisfactorily. As might be inferred, they wished the maximum yield of gutta-percha from each tree with the minimum expenditure of work or time. That the method was extremely wasteful did not concern them nor were they bothered over the prospect of a bankrupt future.

The method, which is still in vogue from the westernmost part of Sumatra to the easternmost point of Mindanao, is, with various minor modifications, practically as follows: The tree is first cut down and the larger branches at once looped off, the collectors say to prevent the gutta-percha milk from flowing back into the small branches and leaves. As has been previously stated the milk or latex is contained in the inner layers of the bark and leaves, in small capillary tubes or ducts. To open these so as to permit the maximum amount of milk to escape, the natives cut rings in the bark about two feet apart along the entire length of the trunk. The milk, as it flows out, is collected in gourds, cocoanut shells, large leaves, or, in some districts in the chopped-up bark itself, which is left adhering to the tree for the purpose of acting as a sort of sponge. After one or two hours, when the milk has ceased to flow, the contents of the receptacles are united and boiled over a fire for the purpose of finishing the partial coagulation. The warm, soft mass is then worked with cold water until a considerable amount of the liquid is mechanically inclosed. To further increase the weight, chopped bark, stones, etc., are added and the whole mass worked into the required shape with most of the dirt on the inside.

The gutta-percha gathered in this way well repays the amount of work expended. The two vital defects of the method are—

(1) The method is very wasteful, the yield from each tree being a small proportion to the total amount. What this per cent is has been investigated by scientists with the result that the figures differ widely. Remembering that the gutta-percha milk is contained in capillary ducts and tubes, it will be seen that a considerable amount can not flow out on account of capillary attraction, no matter how much cutting is done. It very seldom happens also that a tree falls in such a way that all its trunk is exposed so as to admit of ringing on all sides. As a general thing from one-third to one-half of it is inaccessible to the process of ringing, and all the milk within this portion is consequently lost. Even the larger limbs are not deemed worth ringing and consequently all the milk in them and in the leaves also goes to waste; to this must be added the considerable quantity spilled on the ground through carelessness and lack of enough receptacles for every cut or bruise from which the milk flows.

The method employed to find what percentage of gutta-percha has been removed from a tree by the native collectors was to determine the per cent of gutta-percha remaining in a given area of the bark, multiplying this by the total bark area of the tree and adding 15 per cent of this amount for that contained in the bark of the branches and in the leaves.

The amount which the native collectors secure from the average full-grown tree apparently varies according to the species, season, personnel of collectors, etc. Most authorities place the amount per tree at one-fourth of a pound. The director of the botanical garden in Penang (8) secured 1½ pounds of clear gutta-percha from a large tree (*Pal. gutta*) estimated to be 60 years old. Wray (9) obtained somewhat over 2 pounds from a *Palaquium gutta* tree at least 100 years old, and 2½ pounds from one of an inferior species.

Burck (10) made some extended experiments in Sumatra and secured an average of less than 1 pound from full-grown trees, while Serullas (11) in Sumatra obtained almost 1 pound from a giant tree. Trees of inferior grade have been found to give as high as 8 pounds. Probably the best average obtainable is 3 pounds. In the Tiruray district of Mindanao I secured 1 pound of clean gutta-percha from a tree 135 feet high and 5 feet 4 inches in circumference at the base. The work was carefully done by the natives. Taking a measured amount of the bark of this tree after no more gutta-percha could be collected by the native method, and extracting all of the gutta-percha which it still contained, it was estimated that after collection there still remained 6½ pounds of gutta-percha. Taking into consideration the fact that had the tree not fallen in such a way as to leave almost all of the trunk propped high enough above the ground to allow the milk to be extracted from the bark on the under side, the amount extracted would undoubtedly have been much less, or in other words ten times more gutta-percha would have been left to rot with the tree than was taken from it by the natives. Other investigators have secured figures as large as these and some found that forty times more gutta-percha was left behind than was secured by the careless collectors.

(2) It leaves the future unprovided for. It has been seen that the invariable practice of the native collectors is to fell the tree in order to extract the gutta-percha. In some cases it has been reported that the stumps stool afterwards, and in course of time produce new trees, but it can be safely asserted that this is the exception and not the rule. Of those I have found cut down in the Philippines, none have ever stooled, though in one case I saw some of the roots of the stump alive long after the felled tree was well advanced toward decay.

It is fortunate that only the full-grown trees contain enough gutta-percha to repay the work of felling, ringing, etc.; otherwise the complete extermination of the gutta-percha forest would only be a matter of a year or so. On the other hand the felling of all the trees old enough to bear seed works to the same end with a somewhat longer time limit.

(B) MARKETING.

Having been collected and put in marketable shape, the gutta-percha is carried in baskets on the back of the collectors to the nearest waterway and thence by boat to the most accessible town, where, applying the description to the Philippines, it is exchanged for barter to some Moro, Chinese, or Filipino merchant (comerciante) living there for the purpose of dealing in all kinds of native products. From here it is shipped to one of the ports doing an export trade with Borneo and Singapore. The entire gutta-percha trade is practically in the hands of the Chinese in the latter city, and they guard the secrets of boiling, working over, mixing, adulterating, and coloring the gutta-percha for European markets most zealously. All who have tried to investigate their methods agree that there is no connection between the various grades and the different tree species, and that pure gutta-percha from the species *Palaquium gutta* is no longer found on the market unmixed with inferior grades.

Strangely enough, I was unable to find in Singapore any statistics regarding the importation of Philippine gutta-percha. The Chinese dealers denied receiving any, and beyond a few piculs noted in the annual import statistics, no mention of it was found anywhere. I afterwards ascertained that the gutta-percha first goes to Sandakan and Labuan, in British North Borneo, and is there transshipped to Singapore, entering as North Borneo gutta percha.

Unfortunately the amount collected for exportation can not be given with any degree of accuracy, as the export statistics (12) include gutta-percha with all other gums. It is known, however, that the amount reaches into tens of thousands of pounds.

V. LAWS REGULATING COLLECTING AND SHIPPING.

Considering the almost lawless way in which gutta-percha is collected and marketed, it is pertinent to review briefly the few steps taken toward legislating on the subject. The English long ago realized that the gutta-percha forests of the Malay Peninsula were doomed to destruction unless radical measures were taken to change the method of collecting. The first law passed was to prohibit the felling of trees in order to collect the gutta-percha. As the law never penetrated to the wild tribes of the interior where the collecting was done, it was not effective. As a surer method of stopping the destruction, a second law was passed which prohibited the exportation of gutta-percha from coast towns in the Federated Malay States in which the English could, of course, exercise personal supervision. The result was that the exportation from those places ceased promptly, but the felling of trees did not stop, the export simply traveling northward by overland routes until it was outside of English jurisdiction, and from there it was shipped to Singapore. I can not find that anything effectual has been accomplished by the English or by the Dutch authorities in Sumatra and Borneo toward remedying the difficulty. It seems to be generally realized at last that wild natives can not be prohibited from doing things where there is no law nor show of authority. Certainly they will not cease felling gutta-percha trees until some one can show them an easier method for collecting the same amount or more of the material, so long as gutta-percha has a market value. The English had the true idea when they took away its market value through prohibiting exportation. The only trouble was that the Malay States are on a peninsula and not an island. This law, if applied to the Philippines, might succeed better by reason of their geographical situation, but so far nothing of this kind has been tried here. As soon as the forestry bureau was established in 1899, the felling of gutta-percha trees was prohibited (13.) Rules and regulations were provided for tapping the bark of the tree with a bolo in such a manner as to allow the milk to be secured without killing the tree. As the amount of gutta-percha obtained by this process was much less than that secured from felling the tree, while the labor was fully as great and was dangerous besides (some trees being 70 feet to the first limb) the wild natives never practiced this method, nor did they ever hear of it, and all the gutta-percha so far exported has been at the expense of so many trees killed.

Islands such as Mindanao and Tawi-Tawi can not stand this for any length of time, and already the gutta-percha trees have entirely disappeared from the vicinity of the coast regions and of the large rivers. According to the forest surveys made so far in the islands the average number of trees of 1 foot in diameter is between forty and fifty per acre, and considering the large number of species found in the forests the number of trees of any one species is generally placed at four or five. With this liberal allowance the forest acreage of the southern islands will probably supply gutta-percha at the present rate of cutting for three or four years longer, but not for more than that.

It must not be supposed that scientific investigation has not been directed toward solving this vexed question of securing gutta-percha in paying quantities without killing the trees, but before describing the results of this work, the chemical and physical characteristics of gutta-percha as well as the prices to be realized for it must be considered in order to demonstrate the difficulties to be overcome.

VI. GRADES AND PRICES.

The prices governing the sales of all grades and kinds of gutta-percha in Singapore, the chief market of the world, seem to be most arbitrary and uncertain. As a general thing they have increased continuously and steadily since the beginning of the industry.

Formerly the different grades of gutta-percha were named from the well-known districts or shipping ports from which they came. An attempt was also made to designate the species of tree furnishing the product, and a further distinction was given as to quality. For instance "Koatei guta merah No. 1" was first grade of gutta-percha from *Palaquium gutta* coming from Koatei, while "Pahang white soondi No. 1" was first-grade gutta-percha from *Payena leerii* from the Pahang district.

These names and gradings are still kept up as a matter of convenience for cable codes, etc., but the significance of the names is almost entirely lost, certainly as far as any indication of the tree species is concerned and often as regards the district of production as well. The Philippine gutta-percha, for example, has neither grading nor price in Singapore and probably comes in under Sarawak white, red, etc.

As has been stated previously, the secrets governing the selection, boiling, adulteration, coloring, etc., of the various grades are closed and known to the Chinese exclusively. This is also true in the Philippines, though very little except boiling and cleaning is attempted before shipping to Sandakan.

Most of the Philippine gutta-percha passes through three hands and the rise in price is quick and decided. My experiences in the gutta-percha districts of Mindanao and Tawi-Tawi were to the effect that the wild native collector had to take about what he could get, which was on an average of $10, Mexican, for a picul of 162½ pounds. Money was seldom paid, the usual thing being barter in rice, cloth, copper wire, cheap jewelry, beads, etc. It is needless to remark that the middleman realized a good profit on his merchandise. He, in turn, carried the gutta-percha to the export towns and sold it to the Chinese at the rate of $40 to $80, Mexican, per picul of 137½ pounds. As this latter amount was the legal weight for a picul, his profits were increased by the additional pounds which he deliberately stole from the ignorant natives. The Chinese exporter pays $5 to $7, Mexican, per picul forestry dues (he being the only one of the three with a fixed residence and amenable to forestry regulations) and exports the gutta-percha to Sandakan or Singapore, where it probably brings $100 to $150, Mexican, per picul of 133⅓ pounds. There is no definite information on this subject, however, as Philippine gutta-percha, as has been stated, is neither rated nor graded in Singapore. A year and a half ago, when the best grade of gutta-percha in the Philippines was said by the Chinese of Cottabato to be worth $80 per picul, the following analyses of Singapore gutta-perchas were made by Van Romburgh and Tromp de Haas (14):

Grade.	Dirt.	Water	Resins.	Gutta.	Price per picul.[a]
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	
Bila (red) soondi	33.6	7.0	31.4	28.0	$150
Sarawak soondi No. 2	37.1	6.8	25.5	29.6	135
Penang gutta Palelo No. 1	2.1	5.8	53.8	38.3	180
Sarawak red soondi No. 1	19.0	3.9	35.5	41.6	350
Bagan white soondi No. 1	.7	8.6	36.5	54.2	350
Koatei guta merah No. 2	21.7	5.1	28.5	44.7	360
Indragiri white soondi	2.0	4.1	46.2	47.7	370
Sambas white soondi	1.0	4.4	53.6	41.0	380
Koatei guta merah No. 1	14.8	3.8	34.8	46.6	500
Pahang white soondi No. 1	4.2	.5	12.8	82.5	500

[a] Mexican currency.

According to these analyses, the best grades of Philippine gutta-percha may well rank with any of the first four on the list, especially as my chemical and physical tests show the high grade of the gutta in them.

Another example of the difficulty in dealing with the Chinese gutta-percha merchants in Singapore is the experience of an American merchant of Manila, who, about this time, took a considerable quantity of the best grade of gutta-percha from Mindanao over to Singapore by way of speculation. He was only offered $8 per picul by the leading merchants there, and it was not until they found out he was not anxious to sell at all but would ship the product to America, that they finally closed with him at $70 per picul. How much the gutta-percha was really worth he never found out.

The evidence then all goes to show that the price of Philippine gutta-percha jumps from about $8 a picul in the mountains where it is gathered by the wild tribes to $150 in Singapore. Thus, the native collectors get almost nothing, the government about as much, and the Chinese the rest. The Chinese might possibly get even higher prices by exporting direct to London or America, though apparently that has not yet been tried.

It is stated on good authority that the Chinese in all their manipulations for preparing the gutta-percha for the European market go solely by smell, color, toughness, and the softening and hardening test in hot, then cold, water. At any rate, they are certainly very skillful in the work, although careful inspection of the above table, as Van Romburgh points out, would tend to show that their prices were not at all warranted by the analyses. So long as the collecting of the gutta-percha is all in the hands of wild natives and the manipulating and marketing controlled by the Chinese, we can not hope to have the gutta-percha trade on a fair business basis. However, as the supply steadily decreases while the demand and prices increase, the attention of governments and manufacturers will more than ever before be directed to the subject, and perhaps the hoped-for relief will come through scientific propagation of gutta-percha trees and scientific collecting of the gutta-percha.

VII. CHEMICAL PROPERTIES.

A chemical examination of the milk or latex above referred to as coming from the gutta-percha trees upon wounding the bark shows it to be composed of an emulsion of water and oil in a finely divided state. According to the species of tree the water varies from a small (best species) to a very large percentage (poor species).

A drop of the milk caught on the finger undergoes no apparent change for a few minutes, but by the end of this time a thin rubbery scum can be observed to have formed on the surface. If this be removed, a second film will form, and so on until the entire drop has become a small piece of a tough, leathery substance. When a fresh drop is worked between the fingers, the hardening process or coagulation takes place very quickly, and by boiling or adding certain chemicals, such as mineral or vegetable acids, alum, salt, etc., it takes place almost instantaneously. What the nature of this hardening process is, appears to be unknown. The subject will be investigated in this laboratory.

After coagulation sets in (see below), the oily portion becomes hard and tough, while most of the water separates or is inclosed mechanically. Subjecting this hard and tough mass, taken, for example, from the *Palaquium gutta* species, to further examination, it proves to be insoluble in water and very stable against the action of either dilute acids or alkalies. In chloroform or carbon bisulphide it is easily soluble, while ether, petroleum ether, and alcohol dissolve it only in part. By subjecting it to the action of cold alcohol, a yellow amorphous resinous powder can be extracted. Hot alcohol further extracts a white crystalline resin, leaving a tough horn-like residue, which is easily soluble in chloroform and carbon bisulphide and can be precipitated from these solutions by alcohol as a white flocculent mass, which by warming or through pressure quickly returns to its original appearance. Taking the three constituents of gutta-percha in the order described above, the names Fluavil, Alban, and Gutta were given them by Payen (15) in 1852. Besides these constituents, all gutta-percha was found to contain more or less dirt, coloring matter, and water inclosed mechanically.

TABLE NO. 2.—*Analyses of representative samples of gutta-percha from Singapore and Philippine markets, as well as from different species of gutta-percha trees, to show composition and comparisons.*

Source of specimen.	Appearance.	Gutta.	Resins.	Water.	Dirt.	Grade.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	
1. Collected from Pal. gutta trees in experiment garden, Buitenzorg, Java.	Close, compact, tough, whitish to pink and brown.	74.77	20.74	2.49	1.99	Superior, but not on Singapore market.
2. Sample analysis of product of Pal. gutta made by Van Romburgh.	....	85.15	11.02	2.08	1.75	Do.
3. Product from two trees of Pal. leerii, Tawi-Tawi.	White, somewhat elastic, very tough.	48.19	41.38	6.59	2.05	Superior in Philippines.[a]
4. Product from tree of Pal. mindanæsne; in mountains southeast of Cotabato.	Somewhat tough, white, pinkish, and brown.	38.42	49.08	9.76	2.72	First.
5. Brought into Cotabato by Moros from Subano region, northwest of Tucuran.	Clean, pinkish balls; tough.	32.49	54.08	7.61	5.76	Do.
6. Purchased from Moros at Bongao.	Tough, compact slab.	28.37	37.42	18.32	15.83	Second.
7. Product from tree of Pal. celebicum; in mountains southeast of Cotabato.	Inclined to crumble; white to brownish.	31.30	51.86	04	16.79	Do.
8. Brought into Cotabato by Moros from Binang region; botanical origin unknown.	Long coils on piece of bamboo; dirty and dark colored.	30.20	57.40	7.80	4.60	Do.
9. Product from unknown species; in mountains southeast of Cotabato.	Dark brown, hard, and crumbling.	23.64	53.99	13.87	8.48	Third.
10. Product from Pal. ahernianum; in mountains north of Tucuran, Mindanao.	Heavy, compact mass, crumbling easily; light reddish brown.	24.55	43.21	15.19	17.04	Fourth.

[a] The grading of the Philippine gutta-percha is done by the Chinese exporters.

The method adopted for making the above analyses is a modification of those used by Obach (16) and Van Romburgh. The former determined first the per cent of water by drying a weighed sample to constant weight on a water bath or desiccator determining the water by difference. The resins were then extracted with ether and weighed after the solvent had been completely evaporated. The gutta and dirt were thus left and were separated by chloroform, which dissolved the gutta, leaving the dirt to be filtered, dried, and weighed. The chloroform was then evaporated and the gutta weighed.

Van Romburgh (17), in his latest analytical work, uses the following scheme: The weighed and finely divided substance is dried to constant weight in an atmosphere of dry carbon-dioxide gas, which fulfills the double purpose or drying and at the same time preventing oxidation. The sample is then dissolved in hot chloroform, thus allowing the undissolved dirt to be filtered off, washed, dried, and weighed. The chloroform solution containing the gutta and resins is diluted with chloroform to 100 c. c. and an aliquot portion taken, evaporated, and dried to constant weight as above. By extracting the residue with hot alcohol or acetone the resins are removed, when the remaining gutta is dried and weighed. The resins are then estimated by difference. Van Romburgh points out that the largest source of error in using this method is due to the evaporation of the chloroform. To avoid this loss and save time the following modifications were adopted by me:

DIRT.

A fair sample of the gutta-percha to be analyzed was finely divided and quartered down to a small amount. Of this, 0.3 to 0.5 gram was taken in a weighed thimble filter and extracted hot in a Soxhlett apparatus, chloroform being used as the solvent. When all was dissolved but the dirt the latter was dried on the filter and weighed.

RESINS AND GUTTA.

The chloroform solution is then evaporated to dryness in the flask (previously tarred) attached to the extractor and dried to constant weight on the water bath in a stream of dry carbon-dioxide gas. After weighing, the contents are extracted with hot alcohol or acetone, when the flask is again dried as before and weighed. The loss in weight equals the weight of resins and gain of the flask the weight of gutta. The water is estimated by difference.

Analyses of samples taken from several trees of one species show the percentages of the constituents to vary considerably, they being influenced, probably, by the age of the tree, the conditions of its growth (soil, moisture, shade, etc.), as well as by the season at which the sample was taken. For illustration of this, two analyses of gutta-percha, known to have been taken from different trees of *Palaquium gutta*, are given to show the large variation in the percentage of gutta. It must therefore, be understood that the figures obtained from the analyses of the gutta-percha taken from any one tree will not necessarily represent the exact values for that species. An average from a number of trees is necessary to secure true values. In the same way samples from any commercial grade of gutta-percha may vary quite a little in their percentage composition, the differences, however, generally falling within a well-defined limit.

The "dirt" found in all commercial gutta-percha, as has been stated, may be there unintentionally, or have been added with intent to defraud. In either case it generally consists of finely chopped bark, leaves, small sticks, etc. From 2 to 6 per cent of dirt is not only admissible, but generally unavoidable, while more than that is looked upon with suspicion. So intimately is some of the dirt mixed with the gutta-percha that even the best machines fail to eliminate the last 1 or 2 per cent.

A certain amount of coloring matter which exudes from the bark when it is cut is also mixed with the gutta-percha milk, and colors the resulting product. Certain species give a distinctive color to the material taken from them, so it has become a practice of the Chinese in Singapore to boil inferior grades with the bark of the best species, in order to give them the correct color.

Under "resins" are considered the resinous-like substances which, with gutta, go to form the substance gutta-percha. These resins vary greatly in appearance. In gutta-percha from *Palaquium gutta*, for example, as has already been stated, one is a white crystalline mass, while the other a yellow amorphous powder. In other species they may be oily or brittle, colored or white. Judging from the formulas $C_{10}H_{16}O$ and $(C_{10}H_{16}O)_x$ which have been given to alban and fluavil, respectively, it might be inferred that these resins are oxidation of products of gutta $(C_{10}H_{16})_x$. Sufficient work has not yet been done on these bodies, however, to make this anything more than conjecture.

Again, taking the gutta-percha from *Palaquium gutta*, for illustration, it is found that the 10 to 20 per cent of resins which it contains is not a detriment, but rather a decided advantage. Besides adding much to the bulk, these substances are insoluble in water, poor conductors of electricity, and quite stable against the action of air and moisture. In fact, gutta-percha at present prepared for the insulation of submarine cables is composed of one part of resins to every two parts of gutta. When the amount of resin passes this percentage, however, the toughness of the gutta-percha is lessened and other objectionable qualities become apparent. The necessity, then, of knowing the percentage of resin in a given quality of gutta-percha before using it for manufacturing purposes is plainly apparent.

As might be inferred from the preceding, the "gutta" is the principal constituent in gutta-percha. The methods of separating it from the other constituents have been given and its indifference toward dilute acids and alkalis noted. Concentrated nitric acid causes violent oxidation, while sulphuric acid carbonizes it in a short time. Alkalis, even when concentrated, have practically no action on it. The best solvents for gutta are chloroform, carbon bisulphide, and carbon tetrachloride. From all of these solutions it may be reprecipitated by the addition of alcohol.

If gutta be subjected to dry distillation isopren C_5H_8 and kautchin $C_{10}H_{16}$ (18) distill over as the chief decomposition products, and are identical with the isopren and kautchin (19) recovered from the dry distillation of rubber. Tilden (20) succeeded in changing isopren back again into a rubber-like substance through the action of concentrated hydrochloric acid. Isopren, according to Ipatiew and Wittorf (21), is methyl divinyl $CH_2{=}C\,(CH_3){-}CH{=}CH_2$, so that both gutta and rubber will perhaps be found to be polimerization products of isopren.

The discussion has so far been of the gutta found in the species *Palaquium gutta.* Dr. Eugene Obach (22), as chemist for a large cable insulating company, made analyses of specimens of gutta percha from different species of trees as well as from many grades of commercial gutta-percha. In his table of analyses he puts under the name of "gutta" the substance found in each sample, which was insoluble in boiling alcohol, but soluble in chloroform. The "guttas" thus found were variously colored from white to dark brown, and possessed different tensile strength, from "elastic" and "very strong" to "brittle." Obach thus used certain slight chemical similarities as his criterion of a gutta and neglected, apparently, the wide physical differences, which, as will be shown later, these bodies display. Provided there are many kinds of guttas, it is easily understood why a chemical analysis alone of a gutta percha will give almost no insight into its value unless accompanied by physical tests of the gutta contained in it.

VIII. PHYSICAL TESTS OF GUTTA.

Before going further with the discussion as to whether chemical or physical tests should decide what is or is not "gutta," attention is called to the various physical properties of these bodies. To provide material for these physical tests, they were isolated in considerable quantities from various representative Singapore and Philippine gutta-perchas by means of solvents, and after evaporation were dried in a stream of dry carbondioxide gas to prevent any possible oxidation. When heated to the temperature of boiling water, they could be easily cut or molded into the necessary shape for performing the following experiments:

Gutta.	Color.	Action toward light.		Heat, softening temperature	Stress, tensile strength (pounds).
		Refractive index.	Rotation in 0.5 per cent solution.		
		70 ° C.		° *C.*	*Sq. inch.*
No. 1	Light brown	1.5093	6.75	62	5262.4
No. 3	Cream white	1.5088	6.50	60	6668.15
No. 4	Yellowish white	1.5089	7.50	61	5134.7
No. 5	Very light chocolate	1.5093	6.50	61	6451.45
No. 10	Cream white	1.5076	4.75	56	(*a*)

a Brittle. (The numbers in this table refer to Table No. 2.)

EXPLANATION OF TABLE.[a]

The "color" of the guttas undoubtedly comes from the bark of the tree when cut to secure the gutta-percha, for, by repeated solution and precipitation, the color may be almost entirely eliminated, leaving the gutta only slightly tinted from a cream color to light pink, and pure white when finely divided. It is my opinion that all variations of color are only incidental and not connected with the chemical structure of the gutta itself. The amount of color in the above samples was a minimum and not sufficient to have any material effect on the physical properties. The experiments with light—namely, those given under refractive index and rotation are employed with great success in the commercial analysis of sugars, oils, fats, butters, etc. This is due to the fact that each chemical individual, providing it is capable of transmitting light, has an index of refraction peculiar to itself, which, for purposes of comparison, must be taken under constant conditions and, provided it is able to rotate the plane of polarized light, a degree of rotation which is also constant. While two chemical individuals may show identity in some one physical property, they can not continue this identity in two or more, so that more than one method was necessary to determine the relationship of the guttas examined by me. Substitution, adulteration, or variation in chemical structure can in this way be easily discovered and determined. Owing to certain mechanical and chemical difficulties encountered in making these determinations on the guttas, the limits of error of experimentation are outside of the differences found between Nos. 1, 3, 4, and 5, but do not include the marked difference displayed by No. 10. In determining the refractive index, an Abbe-Zeiss refractometer was employed, a small amount of a concentrated solution of pure gutta in chloroform placed on each of the prisms and allowed to stand until the odor of chloroform had entirely disappeared. The prisms were then closed and kept at a temperature of 70° C. until the readings became constant, showing that all chloroform had evaporated. The above figures are the results of many determinations made with carefully prepared samples.

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[a] The results given in this table and some of the explanations appeared in the previous annual report of the superintendent of government laboratories, but as subsequent experience and the completion of botanical data has led me to take up the subject from a different standpoint, they are again appended for the sake of completeness.

The rotation was determined in choloroform, 0.5 per cent solution being used, because, when more concentrated, the absorption of light was too great to admit of accurate readings.

The physical tests given in the above tables are so diversified as to bring out clearly the extent of resemblance between the various samples of gutta submitted to them. The results show little variation between Nos. 1, 3, 4, and 5. Indeed, these samples may be regarded as practically identical in composition. The physical constants appear to be those of a single chemical individual, the refractive index varies only in the third decimal place, the rotation is the same within the limits of only 1°, and the softening points vary only from 60° to 62°. The small amount of resins in the specimens, which it was impossible to remove, would be sufficient to account for even greater variations. No. 1, however, is the best sample, used for a standard and taken from *Dichopsis gutta;* Nos. 3, 4, and 5 are from the Philippine Islands. It would appear from this that gutta is a chemical individual, identical in all cases, and any substance, such as No. 10, for example, which varies from the properties recorded above, should not be designated as such. This opinion is, however, advanced, subject to further confirmation by extended chemical investigation looking toward the determination of the chemical constitution of gutta. In the case of sample No. 10 the substance designated as gutta, and the real gutta of No. 3 are very similar in appearance and chemical behavior. In tensile strength, however, they are widely divergent, and this difference is accentuated and not lessened by the other physical tests, for while these latter differences are not so marked, yet they clearly show that all the physical constants of No. 10 differ more or less from all the others, and hence this substance must certainly be different in chemical constitution.

The action of heat in softening gutta-percha and making it plastic has previously been used as a test of value. It has been found that the best grades require a higher temperature to soften them than the lower grades. According to the results obtained by me, the inferior grade of gutta (No. 10) also possesses the property of softening at a lower temperature than the superior gutta. The softening point was determined by molding a piece of gutta into the bottom of a glass tube sealed below, placing a sharp pointed glass rod in contact with the surface, and gradually heating in a bath of sulphuric acid until the point of the glass rod just began to enter the gutta.

The tensile strength, or toughness, possessed by gutta, next to its resistance to sea water, is undoubtedly its greatest merit commercially. Even the inferior grades of gutta-percha are used for objects requiring toughness combined with pliability and strength. In the insulation of a submarine cable great toughness is imperative, for during the laying of the cable it is constantly subjected to great strains from kinking, pulling, rubbing, etc., and when it has reached to the ocean bottom, where the pressure is often three and a half tons to the square inch, it must not have sustained a fracture even as large as the diameter of a fine hair for otherwise the moisture would slowly penetrate to the wires, the insulation would not be complete, and the cable would have to be pulled up and repaired.

In order that the measurements made might be within the limits of the instruments at hand only small strands of gutta could be used for testing. To make these strands free from minute air bubbles was well-nigh impossible, in consequence of which the breaking was in most cases brought about by weakness due to this source. The figures, while thus only approximate, are below and not above the true values and show clearly the enormous tensile strength of my samples. Obach (23) gives a tensile strength of 5,000 pounds for the best gutta-percha, while for the gutta from it he found about 6,500, which closely corresponds to results given above. This also brings out most clearly the excellent quality of the best Philippine gutta-percha.

The results of the combined chemical and physical tests on various samples of so-called "guttas" extracted from gutta-perchas of different origin seem to show that the gutta from the gutta-percha of *Palaquium gutta* has certain well-defined chemical and physical properties, and they also demonstrate that some so-called gutta-perchas contain a substance which chemically resembles to a certain extent the above-mentioned guttas, but differs widely from it in many of its physical properties. As the gutta from the species *Palaquium gutta* has stood the test of usage for fifty years, it is only fair that its chemical and physical constants should be used as the standard of comparison. Until more is known chemically of such substances as I found in No. 10, a chemical analysis will not be sufficient to determine the value of a gutta-percha, but it must be supplemented by physical tests. This laboratory will undertake the task of so determining the chemical properties of gutta and its allied bodies in the hope of discovering a method of chemical analysis which alone can be used to determine the value of any gutta-percha.

IX. SCIENTIFIC PROPAGATION.

As soon as the native collectors made such heavy inroads on gutta-percha forests as to make certain of their serious decimation if not entire destruction, the various governments having tropical possessions in the East began to take note and make inquiries but it was not until the last four or five years that the notes became serious or the inquiries anxious. Both explorations and inquiries revealed that the greater part of the Malay Peninsula had lost most of its trees, and that the portions of Sumatra and Borneo which were still productive were in the most inaccessible mountain forests of the interior. So thoroughly had the seed-bearing trees been cleared out of the Malay States that a standing reward by government officials for seeds of the species *Palaquium gutta* was not claimed, though the offer stood for a long time. Van Romburgh (24) in a very extensive tour of Sumatra and Borneo, made for the purpose of reporting to the Dutch Government the condition of the gutta-percha regions, saw but a few seed-bearing trees, and these in almost all cases had been protected by native chiefs.

In the botanical gardens of Singapore, Bukit, Tiniah, Penang, and Buitenzorg, *Palaquium gutta* trees were growing which had either been protected from destruction or had been planted for a sufficient length of time to be seed bearing. These formed the nucleus of the gutta-percha nurseries now being planted by the English and Dutch governments, with the purpose of obtaining reliable information as to methods of propagation, the rapidity of growth, the time necessary for maturing, and above all, to furnish material for testing scientific methods for extracting gutta-percha without killing the trees. Owing to the scarcity of seeds everywhere the government botanists were obliged to resort to various methods for securing young plants, and their experiments have been along the following lines:

(*a*) PLANTING FROM SEEDS.

The fresh seeds are laid in beds of rich earth and allowed to germinate and grow under partial shade. When about a foot high they are transplanted to the future plantation, where the soil may be entirely free from trees, shrubs, or other vegetation (Dutch method), or where small patches of earth have been cleaned and loosened for their reception in a forest of secondary growth, heavy enough only to furnish a light shade (English method). By the Dutch method a light shade is required around each seedling until a vigorous growth is secured. The seedlings are set out about 5 by 5 yards apart, though where it is desired to obtain the largest amount of leaves per acre the space allotted is 4 by 4 yards. No special care seems necessary except to keep them free from weeds. Too much stress, however, can not be laid on the care which should be taken not to break or injure the long tap root of the young plant during the process of transplanting, for any injury to it stunts the growth materially or even causes death. Mr. Curtis, director of the Penang Botanical Gardens, has modified the manner of starting the germination and first growth by placing each seed in a separate bamboo joint filled with earth. This joint is made long enough to allow the tap root to strike downwards undisturbed, and when the time comes for transplanting it can be transferred, joint and all, without any fear of injury, to the place made ready for it. The bamboo is then cracked open and the plant inserted in the ground with almost no disturbance of its roots.

The Dutch government in Java, having many seed-bearing trees, is now deeply engaged in carrying out a programme which contemplates the planting of some 150,000 seeds annually until at least 1,000,000 trees are growing. This will be done on extensive government plantations at Tjipitir, Java. The entire management is intrusted to Dr. van Romburgh, director of the government chemical laboratory at Buitenzorg, who has a corps of assistants intrusted with testing the gutta-percha contained in the seed-producing trees in order that none but the best stock may be used.

(*b*) PLANTING FROM SELF-SOWN SEEDLINGS.

In the forests both of Sumatra and Borneo the natives are still able to find comparatively large numbers of self-sown seedlings of the *Palaquium gutta* species. These, when carefully taken up and transplanted into air-tight boxes provided with glass covers and rich earth, can be packed in large numbers in a comparatively small space and shipped to almost any desired distance. For instance, 60,000 such seedlings were shipped two years ago from southern Borneo to the French Congo via Antwerp. The plants transported from Borneo to Singapore in this manner are doing well in the gardens at the latter place. The German government is planning a nursery of such seedlings in its tropical possessions in New Guinea.

(*c*) PROPAGATION BY MEANS OF MARCOTTAGE.

As neither direct slipping nor grafting has ever succeeded with gutta-percha trees, the method called marcottage was tried in Java and the Malay States with some success. This consists in selecting a young straight limb from a large tree and at the point where the roots are to grow the bark is removed for the length of an inch around the entire limb. The denuded spot is then packed with rich mud, which is held in by a coating of cocoanut or other fiber. If the mud is kept moist, and only if this is the case can good results be secured, small roots will generally appear in three to nine months, when the limb can be cut off and planted.

The principal gutta-percha plantations now under cultivation and in which much useful and desired experimenting is being done, are located at Tjipitir and Buitenzorg in Java, on Rhio Island at Singapore, and Bukit Timah on Singapore Island, on Penang Island, and at one or two places in the Federated Malay States. Enough time and work have been spent to demonstrate most conclusively that gutta-percha trees can be raised not only successfully but also without much trouble or great outlay of money, and all the nations having tropical possessions in the East, except the United States, have made a start toward gutta-percha plantations, but the Dutch are the only ones so far who have gone into it on a grand scale, and unless appearances are deceitful they will have a monopoly on the plantations of the gutta-percha of the future, as sure as they have on the forest gutta-percha of the present day.

X. SCIENTIFIC METHODS OF COLLECTING.

Modern methods of collecting gutta-percha have advanced along two lines. Needless to say they were not proposed nor carried out by the wild native collectors who are unwilling to discontinue present gains in favor of future returns. It was previously remarked that the gutta percha is all contained in the bark of the tree and in the leaves. The problem resolved itself into either—

(*a*) Extracting some of the gutta-percha from the bark and leaves without injuring the tree or,

(*b*) Felling the tree and securing the gutta-percha from all of the bark and leaves.

To carry out the first proposition a method was devised similar to that used in South America for extracting rubber milk, by which incisions were made in the bark in a slanting direction up and down the trunk, so cut that the gutta-percha ducts were opened but no injury done to the inside wood of the tree. The milk flowed out to a greater or less extent, and coagulated in strings on the bark. After the flow had ceased and complete coagulation had set in (one day) the strings of gutta-percha were pulled off by hand, washed in hot water, and pressed into cakes. The advantage of this method was that no injury was done the tree although it was tapped repeatedly. The disadvantage lay in the fact that only a small per cent of the total gutta-percha in the tree could be extracted at any one time. According to Van Romburgh's (25) latest experiments with plantation trees (*Palaquium gutta*) about 15 to 17 years old, the yield was 100 grams (nearly one-fifth of a pound) per tree. The gutta-percha thus secured was of the very best.

In addition to the amount thus taken, the leaves both from the living and dead trees contain 8 to 10 per cent by weight of gutta-percha, calculated to the dry leaf. To extract this gutta-percha, two processes have been devised:

(1) The mechanical one, in which the leaf is ground to a powder and then treated with hot water in such a way that the gutta-percha is gradually worked into a compact mass, while the pulp of the leaf is washed away. Up to the present the process has not been perfected, for although the gutta-percha contained is of a good quality the percentage of recovery is smaller than it should be. The largest factory of this kind is being erected near Singapore, and it proposes to use the leaves from a plantation of 100,000 trees on the island of Rhio, some five hours from Singapore.

(2) The chemical process is carried out on the same lines as the mechanical one so far as the grinding of the leaves is concerned. The powder is then extracted with solvents and the dissolved gutta-percha recovered, either through precipitation or through evaporation of the solvent. The details of the process, as well as the solvents used, are kept secret and no patents for this or the mechanical process have been taken out.

The largest factory producing gutta-percha for the market is located at Sarawak, North Borneo, and is very advantageously situated as regards securing leaves from the surrounding gutta-percha forests. It has been claimed, however, that the factory defeated its avowed object of preventing the destruction of the trees, for the native collectors employed would never risk their lives trying to collect leaves from forest trees over 100 feet high, when they could gather them much easier by felling the tree and collecting a goodly amount of gutta-percha in addition. It thus appears that the supply of leaves must come from a plantation where supervision can be exercised.

The plan of felling the gutta-percha trees of the forest and securing all of the material from the bark and leaves is worthy of serious consideration. In the first place, the trees are surely doomed as long as present conditions obtain. If the native can sell the entire bark and leaves for more than he could get for the gutta-percha which he could extract, he will be tempted to bring them in. A second inducement for this method is the fact that many gutta-percha trees cut down even years previously have still much perfectly sound gutta-percha in the rotting bark, which could also be secured. The process of recovering the substance from the bark is practically the same as from the leaves, and about the same per cent is found there as well. With a yield of from ten to fifteen times the present amount recovered from each tree the gutta-percha market would be relieved at once and the extermination of the trees put off many years—long enough, at any rate, to allow plantation trees to take their place.

A large amount of work has been done in this laboratory with the purpose of finding a practical method for extracting the gutta-percha from the bark and leaves of the gutta-percha trees. The process calls for a solvent for the gutta-percha which will dissolve it easily, can be recovered and again used, and above all, has no deleterious effects on the substance.

The result of the experimentation led to a modification of the Obach (26) hardening method for gutta-percha. The process consists in extracting the gutta-percha bark and leaves by means of hot gasoline, the apparatus being provided with reflux condensers. When the gutta-percha has entirely dissolved the solution is allowed to stand until all of the dirt and most of the coloring matter has settled. The clear supernatent liquid is then poured off and cooled to 10° or 15° below freezing. The gutta, with a small amount of resin, is thereby precipitated and can be filtered off through cloth bags and dried. The resulting gutta can be further purified by redissolving in distilled gasoline and reprecipitating. The filtrate containing the dissolved resins is redistilled and the recovered gasoline used for effecting further solution of gutta-percha, thus making the process continuous.

The gutta so secured, on being warmed, can be pressed into any desired form for experimentation. The gutta used in the above experiments was so prepared, and the results of the physical and chemical tests showed it to be unaffected by the process to any appreciable extent. A year's exposure to laboratory fumes has not changed the substance in anyway. The accompanying figure (No. 30) shows some of pressed cakes prepared in the laboratory.

It is to be noted that the process gives practically pure gutta and not gutta-percha, the resins remaining dissolved in the gasoline. This is in itself a great advantage, as the gutta could be used directly for bringing up the percentage in inferior grades of gutta-percha, and so make them suitable for cable insulation. The commercial value of this gutta has not been determined, but should be rated at about $600 Mexican per picul, judging from the price of the best gutta-percha. In this way three piculs of Philippine gutta-percha at $210 Mexican will produce 1 picul of pure gutta valued at $600 Mexican or a gain of $390 for every 3 piculs of gutta-percha (or the equivalent in bark and leaves) handled.

XI. PESTS AND PARASITES.

An instructive bulletin has been issued by Dr. Zimmerman (27) of the 's Lands Plantentuin at Buitenzorg, Java. His field of observation covered the large experimental gardens of Buitenzorg and Tjipitir, where many thousands of gutta-percha trees of various species are now growing. While the same conditions do not obtain there as are encountered in the forest, it is certain that they are as badly if not worse off on account of the multitude of insects of all kinds which are attracted by the other plants of the gardens. In fact, he considers the test a severe one, and his conclusions that there are practically no insect pests which might be considered dangerous is very gratifying. Cattle and goats eat the leaves greedily, and young trees must therefore be protected until high enough to be out of reach.

PART II. RUBBER.

I. HISTORICAL AND DESCRIPTIVE.

Even the shortest outline presenting the subject of rubber in its historical, geographical, botanical, and commercial aspects would be beyond the scope of this report, nor does the part which the Philippines have taken in its production or are likely to take for several years to come, warrant anything more than a brief explanation of the present state of the rubber industry, in order to better understand the present conditions here and the possibility of these islands becoming a new center of the ever-increasing rubber industry.

Rubber, or india rubber, as it seems best known in the United States, was discovered by the Spaniards in the second voyage of Columbus. The Indians of Haiti were found playing with rubber balls which they said were formed from the hardened milk of certain forest trees on the island. In 1755 Dom José, King of Portugal, sent several pairs of his boots to South America to be coated with rubber milk. They must have been made satisfactorily waterproof, for the rubber industry has increased from that day to this.

Not alone was the valley of the Amazon found stocked with rubber trees and vines, but new species were discovered in Central America and Mexico as well. In 1798 rubber-producing vines and trees were encountered in Southern Asia, later on in Central Africa, and by the middle of the nineteenth century almost every tropical country of the world had been searched, and the search had not been in vain.

The number of genera and species—even the families representing the rubber plants—is very large, especially because the production is not confined to trees alone nor to any one country, as is the case with gutta-percha, but includes a large number of vines as well, and its area of production is practically that of the tropical world. While rubber trees predominate in tropical America, Africa and Asia apparently draw their greatest supply from vines. Borneo especially is rich in them to the exclusion of trees. The Philippines were said to contain more trees than vines, but systematic search has so far revealed only vines.

Not until the middle of the last century were the manifold uses to which rubber could be applied well understood and the rubber industry thoroughly established. Statistics show that London imported in 1830 some 46,400 pounds of rubber, and by 1870 this had increased to the enormous amount of 15,211,800 pounds for that one year alone. Since then the consumption has steadily increased, the statistics reading by tons and not pounds, and for 1902 amounted to some 62,650 long tons. London, the former chief center of the rubber trade, has retired in favor of New York. While tropical America in the beginning produced nine-tenths of the rubber supply, it now exports but very little more than one-half of the total amount, India, Burma, Borneo, and Central Africa especially having made giant strides in rubber production. Last year's production for the Malay States, Java, and Borneo was about 1,000 tons. In this was included the amount exported from the Philippines. How much that amount was there is no way of finding out, nor for how long this exportation of rubber has been going on. My investigations in the southern islands convinced me that whatever collecting and exporting has been done concerns the island of Tawi-Tawi alone, and in all probability the latter amount was small. This conclusion is reached because the natives only of Tawi-Tawi know of the commercial value of rubber, and also because I found rubber vines very near the coast on Tawi-Tawi, a sure indication that the search for rubber has not been very careful nor for a long time.

The Philippine Islands are, then, practically a new field for the development of a rubber industry. It will be my purpose, therefore, to show—

(1) The species of rubber-producing plants indigenous to the islands and the amount of territory covered.

(2) The grade of rubber produced.

(3) The Philippines as a rubber-producing country; (*a*) Through utilization of natural supply; (*b*) through introduction of foreign species.

Reference to figs. 31, 32, and 33 will show the two species of vines now known to be well distributed over the islands, both of which produce a good grade of rubber. Owing to my inability to find a vine in fruit or flower, one of them has not yet been determined botanically. Mr. Merrill contributes the following botanical descriptions:

"*Parameria philippinensis* Radlk. (Apocinaceæ).

"An evergreen woody vine, reaching a height of 40 or 50 feet and a diameter of 1 inch or more. Bark gray, with an abundant milky sap. Leaves opposite, ovate, acute or somewhat acuminate, glabrous, 2 to 3 inches long; nerves four pairs; petioles short. Flowers small, white, fragrant, in terminal panicles. Fruit a long, slender, distinctly torulose follicle, 10 to 12 inches long, the swellings over the seeds an inch apart. Seeds one-half inch long, brown, coma white, about twice as long as the seed.

"(*Apocinaceœ.*) Genus undertermined, specimen with leaves only, from the Island of Basilan.

"A very large vine 150 to 200 feet in length, with a diameter of 6 to 8 inches, the bark somewhat rough, greenish. Leaves broadly ovate or obicular, 8 to 10 inches long, abruptly very short acuminate, the acumen less than one-half inch long, glabrous above, pubescent on the nerves beneath, the nerves prominent, about 10 pairs."

It has already been stated that no rubber-producing trees have been found. That is to say, a great many species of trees have been discovered which are known to produce a milk or latex, and while none so far studied contains rubber, it is scarcely to be supposed that when material from all has been collected some at least will not be found to yield a good product.

The extent of territory covered by these two rubber vines is given by map No. 2 (facing page 9). While the *Parameria* is found in Mindoro, Culion, and the other northern islands, the undetermined species is found on Tawi-Tawi, Basilan, and Mindanao. The extent of territory covered in these various places was estimated after extensive personal investigations when all available data had been secured from natives, merchants, etc. In the northern islands, excepting Mindoro, the area covered is given as reported by those who found specimens of the vine. There is every reason to believe, however, that careful investigations would show much larger areas. In Mindoro the natives in all the coast towns knew the rubber vine as "Dactang Ahas" (medicine for snakes), and many of them brought us samples from the neighboring forest. They all reported large numbers of vines in the interior of the island, and the three expeditions made there from the north, west, and south sides confirmed their statements.

In Mindanao the two areas given between Dinas and Tucuran in the mountains near the south coast are the only ones known so far, and even these were only found by accident. The natives knew nothing of rubber, but they had a vine which contained a milky substance, good either as a medicine or for making the heads of their drumsticks. On securing a piece of this peculiar substance from the latter, it was found to be a good sample of rubber. Further explorations to the west and east will probably prove that this vine covers about the same area as that occupied by the gutta-percha trees.

In Basilan and Tawi-Tawi the vine grows abundantly and to a large size. In the latter islands the Moros understand its commercial value, and those engaged in collecting gutta-percha gather rubber at the same time, sometimes mixing the rubber and gutta milk.

II. THE GRADE OF RUBBER PRODUCED.

Rubber milk or latex is contained in the bark of certain vines and trees in exactly the same manner as is gutta-percha. (See fig. 35.) When made to flow, the same phenomenon of coagulation apparently sets in quickly or slowly, according to the species of the plant. In many species of trees the coagulation is very slow and the flow of milk more abundant than with gutta-percha trees. As a result the natives have evolved the method of tapping the trees similar to that shown in figure 36. The milk thus secured is coagulated in a manner similar to that employed with gutta-percha.

Another method, which seems to give the best results and which is employed in the preparation of Para rubber, consists in subjecting thin layers of the milk, placed on the broad end of a paddle, to the coagulating action of smoke produced by burning certain husks which are similar to those of cocoanuts. The smoke contains creosote and acid fumes, which quickly destroy all fungous growths and bacteria which might tend to cause decomposition of the rubber, while the heat removes the greater part of the moisture at the same time.

A chemical analysis of many grades of rubber coming from different species of trees and vines shows them, with the exception of variable amounts of water and dirt, to be composed almost entirely of rubber, with a small per cent of resins. The rubber in all has apparently the same chemical composition, an ultimate analysis giving the formula $C_{10}H_{16}$. Chemically, then, there appears to be only one rubber, while physically certain differences are to be found between samples from different species. Whether the superiority of Para rubber is due, therefore, to the excellence of the rubber itself or to the above-mentioned method of coagulation has not yet been determined. However, it is a fact that Para rubber from the tree species *Hevea brasiliensis* Muell. Arg., is recognized as the standard for grading rubber commercially.

It will be noted that the method before mentioned is one requiring skill, judgment, and the expenditure of considerable labor. In most rubber countries the native collectors possess none of these requisites and are content to employ the crudest methods. In consequence, the rubber obtained is of a low grade, even though the species of tree is of the best.

The Philippine rubber collectors are Samal and Joloano Moros living in Tawi-Tawi and the adjacent coral islands. The method of coagulation used by them was undoubtedly learned from the Moros of North Borneo, who with the Dyaks collect much of the rubber in that island. It consists in first pulling the vine down to the ground so as to be better able to tap it along its entire length. The milk is caught in cocoanut shells or leaves, and coagulated by pouring into sea water. The coagulation is almost instantaneous, and when properly manipulated a large amount of water can be mechanically inclosed inside the large balls along with plenty of chopped-up bark. The resulting rubber, of which I secured many samples, is white, tough, and very elastic so long as it is kept in sea water. On exposure to the air it blackens and decomposition slowly sets in.

The chemical analysis of a sample of this rubber, after much of the dirt and water had been removed, resulted as follows:

	Per cent.
Dirt	3.76
Rubber	81.57
Resins	3.16
Water	11.51

Judging from this analysis the rubber in Singapore would be rated as Borneo No. 1, which sells for $125 Mexican per picul of 133⅓ pounds.

The vines generally die after being pulled down and tapped, probably because of their inability to again reach light and sunshine.

The rubber from the Mindoro species has never apparently been gathered in any quantities even by the natives. When the bark is cut the milk flows readily and coagulates quickly. In appearance it is very similar to the Tawi-Tawi rubber. As yet no chemical analysis has been made. In order to get a valuation of it, a sample was submitted to the Goodyear Rubber Company, of Akron, Ohio, who placed it at about 60 cents per pound after allowance is made for the percentage of water. Larger samples of both kinds of rubber are now being prepared in the laboratory in order that they may be submitted simultaneously to rubber experts.

III. THE PHILLIPPINES AS A RUBBER-PRODUCING COUNTRY.

(A) THROUGH UTILIZATION OF THE NATURAL SUPPLY.

Judging from the way the natives of Tawi-Tawi gathered rubber when left to their own devices, I was convinced that they wasted as large amounts of the milk as they did when they collected gutta-percha—that is, ten to forty times more than they took away. It is evident, then, that under present conditions the history of the rubber vines will be the same as that of the gutta-percha trees, only on a smaller scale. It is useless, in my opinion, to think of tapping them only, for an inspection of their tortuous windings up and around the high forest trees will show the impossibility of ever collecting the milk, no matter how carefully the tapping is done.

To get the full value from the vine the rubber must be extracted from the entire bark. Experiments along that line are now in progress in the laboratory and so far promise well. If the entire vine be cut into pieces and dried, the bark easily separates from the wood and forms 44 per cent of the entire plant. By grinding the bark in any ordinary mill, the rubber separates in the form of small balls while the bark passes off as powder. The dried bark contains 9 to 10 per cent by weight of pure rubber, which shows this substance to be about 4 per cent of the entire vine. The other conditions and details will be investigated by the laboratory with a view of determining methods which will make possible the investment of American capital.

It is true that the method of collecting rubber given above kills the vine. The answer to this objection is found in the fact that when the vine has been cut off, the roots stool again quickly. On a hillside in Mindoro where the natives had burned the forest for the purpose of planting rice, scores of stools from rubber vines were counted while the fire was yet smouldering in some of the old stumps and roots of the large trees.

(B) THROUGH INTRODUCTION OF FOREIGN SPECIES.

It was stated previously that no rubber trees were found in the islands. Exception should be made to the beautiful specimens of the india-rubber tree (*Ficus elastica* Linn.) which were introduced throughout the archipelago by the Spaniards years ago as ornamental shade trees rather than as rubber producers. They are excellent examples of the way foreign species of rubber trees will grow here, and may also serve the still better purpose, that of furnishing seeds and slips to start rubber plantations. Many plantations of the tree have been begun in Java, the reasons for the selection of this species being: (1) The seeds are numerous and the plants grow well; (2) the method of starting new plants by marcottage (see fig. 25) succeeds admirably and the plants have vigorous growth (see fig. 38); (3) the method of coagulation best suited for this milk is the simplest of all. It consists of making many small cuts in the bark of the trunk and allowing the flowing milk to coagulate in strings. When dry and hard they are pulled off and pressed into a compact mass (see mass of rubber on the left, fig. 39) for shipment. The work can be done by even ignorant workmen and with no damage to the tree.

In the Malay States a great many plantations are now being started with Para rubber trees, the seeds of which are secured from the various government botanical gardens as well as from private plantations. One of this species of trees is now growing in Manila, and apparently the climate is suitable. The bureau of agriculture has distributed many Ceara rubber seeds during the past year, and the growth of the seedlings is marvelous.

In general the climatic conditions of most of the islands seem very favorable for the rubber industry. Mindoro and the southern islands especially are advantageous on account of the abundant rainfall distributed throughout the year, with no long season of drought.

What pests and parasites the rubber trees would be troubled with can only be conjectured by reference to the experiences of Java, etc. Doctor Zimmerman (28) extended his work on parasites to include rubber trees, and has found one or two species of insects that may cause damage. Cattle and goats must also be guarded against.

It is needless to dwell on the commercial side of rubber plantations. They are now flourishing in all tropical countries and as an agricultural investment are highly considered. However, in all new countries a certain amount of experimental work must be done before large capital can be safely invested. In India, Burma, the Malay States, and Java this has been accomplished by the respective governments. As soon as methods were perfected and seed supplies provided, private capital began operations at once. From the number of inquiries already made about rubber planting in these islands, it would look as if some movements in this direction are contemplated here, investors only waiting for the government to pave the way. By profiting from the extensive experience of our neighboring countries the experimental era should be short and inexpensive, as a great deal of the pioneer work has been done.

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NOTE.—The following illustrations accompanying this report are on file in the War Department.

FIG. 1.—Moro sailboats ("Vinta") used for traveling among the Southern Islands.
FIG. 2.—Leaves of Palaquium Gutta Burck, grown at the botanical garden at Singapore, Straits Settlements. Furnishes first-grade gutta-percha.
FIG. 3.—Leaves and fruit of Payena Leerii Benth. et Hook. From Buitenzorg, Java. Furnishes second-grade gutta-percha.
FIG. 4.—Leaves of Palaquium Treubii Burck, grown at Buitenzorg, Java. Furnishes second-grade gutta-percha.
FIG. 5.—Palaquium Latifolium Blanco. Province of Tayabas, Luzon.
FIG. 6.—Palaquium Barnesi Merrill. Island of Masbate.
FIG. 7.—Palaquium Ahernianum Merrill. Tucuran, District of Zamboanga, Mindanao.
FIG. 8.—Palaquium Celebicum Burck. District of Cotabato, Mindanao.
FIG. 9.—Palaquium Lanceolatum Blanco. Province of Tayabas, Luzon.
FIG. 10.—Palaquium Gigantifolium Merrill. Province of Tayabas, Luzon.
FIG. 11.—Palaquium Luzoniense (F. Vill.) Vidal. Province of Tayabas, Luzon.
FIG. 12.—Palaquium Mindanaense Merrill. District of Cotabato, Mindanao.
FIG. 13.—Payena Leerii (T. et B.) Benth. et Hook. Tawi-Tawi.
FIG. 14.—Gutta-Percha Leaf (Palaquium Gutta) enlarged, showing the fibers of gutta-percha permeating the leaf interior.
FIG. 15.—Ready to fell a large Gutta-Percha tree for experimental purposes. District of Zamboanga, Mindanao.
FIG. 16.—A large Gutta-Percha tree tapped in such a manner that the flowing milk is all absorbed by the chopped-up bark and none escapes. Tiruray District, Mindanao.
FIG. 17.—Tapping a Gutta-Percha tree in such a manner that all the milk is collected in shells beneath and none lost. Done by Moros in Tawi-Tawi.
FIG. 18.—A Gutta-Percha tree felled and ringed by the Subanos near Curuan, District of Zamboanga, Mindanao.
FIG. 19.—A Gutta-Percha tree tapped in such a manner that the flowing milk is not all absorbed by the chopped-up bark, but much of it is lost on the ground below. Tucuran, District of Zamboanga, Mindanao.
FIG. 20.—A large Gutta-Percha tree felled and ringed. No other Gutta-Percha trees were found growing within a large radius, and no saplings were observed. District of Zamboanga, Mindanao.
FIG. 21.—Stem of Gutta-Percha tree, showing scaffolding erected by Subanos for the purpose of felling the tree. Some roots were still alive, but no stooling was apparent. District of Zamboanga, Mindanao.
FIG. 22.—A Chinese Moro trading boat stopping at Parang Parang, Mindanao, for the purpose of buying Gutta-Percha and taking it to Catobato for exportation.
FIG. 23.—The English method of starting a Gutta-Percha plantation. The seedlings are planted in irregular rows. Bukit Timah, Island of Singapore.
FIG. 24.—Plantation of Gutta-Percha trees (Palaquium Gutta) of various ages. Buitenzorg, Java.
FIG. 25.—Showing the method of propagating Gutta-Percha trees by means of marcottage. Buitenzorg, Java.

Fig. 26.—A Palaquium Gutta tree grown in the open, showing the tendency to bush. Botanical garden, Singapore, Straits Settlements.

Fig. 27.—A tree of Palaquium Gutta just tapped. The flow of milk is quickly stopped by the beginning of coagulation. Tjipitir, Java.

Fig. 28.—A tree of Palaquium Treubii just tapped. The milk has a greater tendency to run than in Palaquium Gutta. Tjipitir, Java.

Fig. 29.—Absence of deep scars or any tendency to decay of a Palaquium Gutta tree, after several years of tapping. Buitenzorg, Java.

Fig. 30.—Samples of pure Gutta prepared in the laboratory for testing and experimental purposes.

Fig. 31.—A Rubber vine (Parameria Philippinensis Radlk.) growing in the forest. Western Mindoro.

Fig. 32.—Rubber vine (Parameria Philippinensis Radlk.) growing in great abundance on the islands of Mindoro and Culion.

Fig. 33.—Rubber vine found in Tawi-Tawi, Basilan and Mindanao. Species undetermined.

Fig. 34.—Rubber vine (Willughbeia Firma Blume). This species supplies most of the rubber produced in Borneo. Botanical garden, Singapore, Straits Settlements.

Fig. 35.—A piece of dry bark from a Rubber vine (Parameria Philippinensis Radlk.) broken and pulled apart, showing the immense number of rubber fibers permeating the interior of the bark.

Fig. 36.—Method of tapping a Para Rubber tree. Third day after tapping. Experimental garden, Buitenzorg, Java.

Fig. 37.—A Rubber vine grown in the forest. To secure a good yield of rubber the vine should be pulled down, all the bark removed, and treated for the extraction of the rubber. Western Mindoro.

Fig. 38.—Plantation of old and young India Rubber trees (Ficus Elastica), the young trees started by Marcottage. Buitenzorg, Java.

Fig. 39.—Exhibit of Para Rubber, showing the yield of trees and different methods of preparing the rubber for market. Perak Province, Federated Malay States.

Fig. 40.—Large India Rubber tree (Ficus Elastica L.). Buitenzorg, Java.

Fig. 41.—Plantation of Para Rubber trees (Hevea Braziliensis) producing seed. Botanical garden, Singapore, Straits Settlements.

Map showing distribution of Palaquium Gutta. Taken from Obach's "Gutta Percha."

Map of the Philippines showing sections where Rubber and Gutta-Percha are grown.

BUREAU OF FORESTRY.

(Bulletin No. 3.)

A COMPILATION OF NOTES ON INDIA RUBBER AND GUTTA-PERCHA.[a]

By Capt. George P. Ahern.

LETTER OF TRANSMITTAL.

Bureau of Forestry,
Manila, November 15, 1905.

Sir: I have the honor to submit herewith for your consideration a compilation of notes on rubber and gutta-percha, giving data concerning the requirements, growth, and treatment of the most important rubber-producing species in different parts of the world. A large number of writers, acquainted with the commercial exploitation of rubber trees and vines, have been consulted and their conclusions compiled.

These notes were gathered together after a number of requests had been made of the undersigned for information concerning the market for crude rubber, price, prospects for rubber growing in these islands, requirements of soil and climatic conditions for the growth of rubber trees, etc.

The data collected by Doctor Sherman and by Philippine botanists and collectors show that the soil, climate, and other conditions are favorable to rubber and gutta-percha in certain parts of these islands.

The government nurseries at Lamao, Bataan Province, have on hand for distribution a number of the more important species of rubber plants, including *Hevea brasiliensis*, *Castilloa elastica*, *Manihot glaziovii*, and *Ficus elastica*.

Of the 29 rubber-producing species enumerated in the above-mentioned notes, the 4 just mentioned furnish the greater part of the world's rubber supply. All of these species have been extensively cultivated in the Orient and have been found to be well suited to the climatic conditions.

In two or three years we should have available for distribution an abundance of seed from each of the above-mentioned species. Experiments in planting rubber trees should be encouraged in a great many different districts in the islands, so that we may learn just where the trees thrive best and under what lcoal conditions a good quality of rubber is produced.

The three great rubber-producing centers of the world at the present time may be broadly classified as follows:

1. *East Indies:* British India, Ceylon, Burma, Straits Settlements, Java, Borneo, etc.
2. *Africa:* Numerous foreign possessions and free states along the coast of Africa; Madagascar.
3. Mexico and South America.

The demand for crude rubber continues to exceed the supply, and from statements made by the leading rubber merchants this condition of affairs shows no prospect of changing.

I would respectfully recommend that these notes be published as Bulletin No. 3.

Very respectfully,

George P. Ahern,
Director of Forestry.

The Secretary of the Interior,
Manila, P. I.

"Twenty-five years ago Mr. John H. Cheever, one of the most successful rubber manufacturers the world has known, bought raw rubber as low as the prices appended, in comparison with which we note the highest New York quotations for corresponding grades within the current year:

[Prices stated in United States currency.]

Grade.	1879.	1905.	Grade.	1879.	1905.
Fine Para	$0.50	$1.33	African	$0.24	$1.04
Coarse Para	.34	.97	Borneo	.47½	.41
Assam	.34	.91	Mozambique	.35	.97

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[a] The illustrations mentioned herein have been omitted and are on file in the War Department.

"The demand for rubber never ceases nor becomes diminished; it promises to grow in years to come as it has done in all the years since the first rubber goods were vulcanized." (From India Rubber World, December 1, 1904, p. 69.)

During the past ten years the imports of raw rubber into the United States have nearly doubled. If we use the official customs returns for the fiscal years ending June 30 the comparison is as follows:

	Pounds.
1893–94	33,737,783
1903–4	59,015,651

Meanwhile, the imports for consumption in other countries have probably increased at a corresponding rate.

An old axiom avers that supply regulates demand, but in regard to rubber we already have an overdemand, and it is the supply that the manufacturers are seeking. The greater the supply, the more numerous will be the uses to which rubber will be applied, and we are assured by both scientists and business men that such a thing as overproduction is impossible. In view of this fact, a large number of companies have in recent years become interested in the establishment and commercial exploitation of various rubber-producing trees.

RUBBER AND GUTTA YIELDING SPECIES.

Of the large number of rubber and gutta yielding species especially fitted for tropical cultivation, M. A. Godefroy-Lebeuf, an eminent French horticulturist, in his Catalogue of Economic and Ornamental Plants, cites:

Landolphia kirkii: Zanzibar rubber.
Landolphia owariensis: Casamance rubber.
Landolphia klainii: Fernand-Vas (French Congo) rubber.
Landolphia sp.: Dubreka (west Africa) rubber.
Landolphia tomentosa: Conakry (west Africa) rubber.
Urceola esculenta: Burma rubber.
Urceola elastica: Borneo rubber.
Manihot glaziovii: Ceara rubber.
Euphorbia sp.: Fort Dauphin (Madagascar) rubber.
Vahea madagascarensis: Diego-Suarez (Madagascar) rubber.
Tabernaemontana sp.: West African tree, with fruit-yielding rubber.
Kickxia africana: Lagos rubber.
Kickxia latifolia: Kassai (Congo) rubber.
Ficus elastica: Assam rubber.
Ficus vogelii: Conakry (west Africa) rubber.
Ficus rubiginosa: Australian rubber.
Castilloa elastica: Central American rubber.
Hevea confusa: Brazilian rubber.
Hevea brasiliensis: Para rubber.
Hancornia speciosa: Pernambuco or "Mangabeira" rubber.
Sapium biglandulosum: Tolima (Colombia) rubber.
Sapium thomsonii: Another Colombian species.
Willoughbeia firma: Malaysian rubber.
Willoughbeia edulis: Laos (China) rubber.
Chonemorpha macrophylla: An ornamental plant from India.
Isonandra gutta: Gutta-percha.
Payena leerii: Gutta-sundek.
Mimusops balata: Balata.
Achras sapota: Chicle. (India Rubber World, Vol. XXIII, No. 1, 1900, p. 14.)

GRADES OF CRUDE RUBBER.

INDIA RUBBER.

"India rubber or caoutchouc consists of the dried coagulated milky juice of various trees and shrubs, belonging chiefly to the natural orders *Euphorbiaceæ*, *Moraceæ*, *Artocarpaceæ*, and *Apocynaceæ*. Although a milky juice is found in plants of many other families, it does not in all cases yield caoutchouc, nor do different species of the same genus yield an equal quantity or quality of that substance. On the other hand, there are many plants which afford a good rubber, but have not yet been sought out for the commercial purposes.

"* * * Caoutchouc differs from other vegetable products of like origin by possessing considerable elasticity, by being insoluble in water or alcohol, alkalies, and acids (with the exception of concentrated nitric and sulphuric acids). Although apparently simple in constitution, it contains not only the elastic substance to which its commercial value is due but a small quantity of an oxidizing, viscid, resinous body soluble in alcohol. This latter substance varies in quantity in different kinds of rubber, those containing the smallest amount, such as Para and Ceara, being considered the most valuable, while those in which it is present in greatest proportion, such as the Guatemala and African rubbers, are the least esteemed." (From Encyclopedia Britannica.)

CAUCHO.

"Caucho is a distinct sort of a rubber, inferior to the Para. * * * It is not cured by smoking, but by the admixture with the milk of lime, potash, or soap."

BALATA.

"In character this gum occupies a position between india rubber and gutta-percha, combining in a degree the elasticity of one with the ductility of the other, and freely softening and becoming plastic and easily molded in hot water. The milk, diluted with water, is said to be drunk by the natives as a substitute for cow's milk. Balata is dried ordinarily by evaporation. A more rapid coagulation is effected by the use of spirits of wine. Alum and sulphate of aluminum are sometimes used to coagulate, but are not very satisfactory. The gum is sometimes mixed during the gathering with the milk that produces gum known as Touchpong and Barta-Balli. Balata shrinks in washing from 25 to 50 per cent. It is used principally in the manufacture of belting and for insulation work. It has also been utilized for golf balls and as a substitute for india rubber in dress shields."

GUTTA-PERCHA.

"Gutta-percha, which was introduced into Europe from Singapore in 1843, was for a while confounded with india rubber, from which it differs in some very important particulars. It becomes soft and plastic on immersion in hot water, retaining the shape then given it on cooling, whereupon it becomes hard, but not brittle, like other gums. India rubber, on the other hand, does not soften in hot water and retains its original elasticity and strength almost unimpaired. The water, as such, exercises no softening action on gutta-percha, the effect being purely one of temperature, which may equally be produced by hot air, only somewhat more slowly. The degree of heat required depends upon the quality of the material, but even the hardest kind becomes plastic above 150° F. Heated in air considerably above the boiling point of water, gutta-percha decomposes and finally ignites, burning with a luminous smoky flame and emitting a pungent odor, resembling that from burning rubber.

"A curious characteristic of gutta-percha is that when it is softened in water, although it is so plastic that it will reproduce the most delicate impressions, it will bear blows from hammers or allow itself to be thrown against a stone wall without being marred." (From Crude Rubber and Compounding Ingredients, pp. 27, 228, by Henry C. Pearson.)

CEARÁ RUBBER (MANIHOT GLAZIOVII).

SOUTH AMERICA.

"The cultivation of Ceará rubber (Manihot glaziovii) was begun in Nicaragua about four years ago. The splendid condition of the plantings and the large yield and excellent quality of the product taken in trial tappings give promise of the success of the enterprise. The Ceará rubber tree is a dry-land plant and will not prosper in a wet soil. In congenial climatic conditions and soil, its early and abundant product and excellent quality make it profitable to plant. The location in which it is being planted in Nicaragua is a part of the districts of La Paz and Momotombo, where the Momotombo Mountain, by driving the clouds to one side, protects this section from the force of the tropical rains, so that it is comparatively dry, receiving just about enough water to grow corn, which is abundant, and for Ceará rubber. The soil is sandy, with an admixture of a very little clay, and very deep or slightly rolling. The elevation above the sea is some 300 feet. The section is traveled by the Nicaragua Central Railroad. The plantation of the San Nicolas belongs to the Nicaragua Rubber Company, and on it are the oldest and largest trees in this section. Three-year-old trees on this plantation measure 26 inches in girth 3 feet above the soil, and are over 30 feet high.

"That Ceará rubber will yield at 2 years of age has been proved on the San Nicolas and neighboring plantations. Twenty-one trees, from 14 to 21 months, with an average age of 14 months, were tapped and together gave 7½ pounds of dry rubber. A tree 15 months old gave 3 ounces of rubber. Many trials have been made, with like results. Still, it is not intended to tap until the trees are 4 years old, in order that they may retain their best development. It is expected that 4-year-old trees will produce 1 pound of rubber per tree, and from that time the product will augment rapidly. There are now in the district, outside of native plantings, four American plantations of Manihot glaziovii, the San Nicolas, La Victoria, El Americano, and El Triunfo, on which are planted some 200,000 trees, while as many more will be planted in another year."

(Report of the San Nicolas Plantation, Nicaragua, South America. India Rubber World, Vol. XXVII, No. 3, Dec., 1902, p. 80.)

"* * * Being familiar with the *Manihot glaziovii*, the rubber of Ceará, Mr. Adler decided that this location (La Paz), in Nicaragua, was well suited for it and purchased 1,000 acres of land there under the name of La Victoria plantation. In February, 1902, work was begun on the clearing of the undergrowth on 300 acres, and in the last week in April the ground was burned over. After the first rains in May, 60,000 seeds were planted, mostly at stake, and the rest in a nursery. During June many of the seeds began to sprout and the seedlings had been appearing daily up to the time of Mr. Adler's writing (November 6). At that date the seedlings, which had first appeared being 5 months old, were 10 and 12 feet in height and 3 to 4½ inches in girth 6 inches from the ground, which Mr. Adler considers 'extraordinary growth even for the Manihot glaziovii.' So rapid was the growth of the plants in the nursery that many had to be transplanted at the age of 4 weeks, instead of being allowed to remain in the beds for a year, as originally intended. Mr. Adler has found the best results from allowing the sun's rays full access to the rubber plants, for then the trunks became full and strong, whereas if any other growth is allowed around the young plant, they grow slender and lack strength to support the weight of the leaves." (Report of La Victoria Plantation, La Paz, Nicaragua, South America. Indian Rubber World, Vol. XXVII, No. 3, Dec., 1902, p. 80.)

"* * * The United States consul at Sergipe (Brazil) mentions that in 1898 the State appointed a commission to report upon the introduction of the Ceará variety of rubber for cultivation, should it prove advisable. The commission visited Ceará, where the manicoba rubber trees were originally found wild and are now under extensive cultivation, and as a result of their investigation manicoba has been planted in various parts of Sergipe. The consul has seen two plantations, one with about 17,000 trees and the other with more than 20,000, both 3 years of age and apparently in a flourishing condition. Manicoba is grown from seed, planted at the commencement of the rainy season, 12 to 15 feet apart, usually three seeds to a hill, the most vigorous resulting plant being left to stand. Some planters file one end of the hard seed (which resembles the seed of the castor bean) to assist germination; others soak the seeds before planting; but generally the seed is planted without previous preparation. It is said that the plant will grow on run-down sugar lands. It is cultivated on the sandy soils of Ceará, but it doubtless will succeed best on good farming soil. The tree requires little attention, in many places the soil receiving no cultivation, and reaches a height of from 12 to 36 feet in four to six years. It yields rubber at a very early age, the average stated at about two and a half years from planting, when from 7 to 35 ounces of rubber may be obtained by removing from the trunk a V-shaped piece of bark, to the lower angle of which a small vessel is placed to collect the latex. Coagulation is assisted by smoking, as in the case of Para rubber, though the latex will coagulate spontaneously in the air. The cost of planting and gathering the initial crop is stated to be less than in the case of coffee, sugar, or cotton, while the profit is greater, and the consul believes that the new industry will become important." (India Rubber World, Vol. XXVI, No. 5, Aug., 1902, p. 352.)

CASTILLOA ELASTICA—THE CENTRAL AMERICAN RUBBER TREE, MEXICO AND SOUTH AMERICA.

RUBBER CULTURE.

[By O. F. Cook, Bureau of Plant Industry, United States Department of Agriculture.]

"The culture of the Central American rubber tree has passed the experimental stage, in the sense that the practicability of the agricultural production of rubber has been demonstrated; but, on the other hand, it has been ascertained that the tree may thrive where it will yield little or no rubber. Under favorable natural conditions the culture of *Castilla elastica* (the spelling *Castilla*, instead of *Castilloa*, has been adopted in Washington on account of its being the original form) bids fair to become very profitable, but the experimental determination of the factors which influence the production of rubber has scarcely begun.

"In southern Mexico and Central America, the regions well adapted to the culture of *Castilla* are much more limited than has been supposed. The presence of the wild *Castilla* trees is not a sufficient evidence that a locality is suited to commercial rubber culture.

"Differences in the rubber yield are due not merely to the existence of different species and varieties of *Castilla*, but are also controlled by external conditions. The functions of the rubber milk in the economy of the plant are not well understood or agreed upon by botanists; but there are numerous reasons for holding that in *Castilla* and many other plants it aids in resisting drought.

"A continuously humid climate is not necessary to the growth and the productiveness of *Castilla*. The indications are rather that the quantity of milk and the percentage of rubber are both increased by an alternation of wet and dry seasons. In its wild state *Castilla* does not flourish in the denser forests, but requires more open situations. It is confined to forest regions only by the perishability of its seeds. *Castilla* thrives better when planted in the open than in the dense forests; even young seedlings are not injured by full exposure to the sun, providing that the ground does not become too dry. The planting of *Castilla* under shade or in partially cleared forests is to be advised only on account of special conditions or as a means of saving labor and expense.

"The loss of the leaves in the dry season may be explained as a protection against drought, and does not indicate conditions unfavorable to the tree or to the protection of rubber. The falling of the leaves of *Castilla elastica* in the dry season renders it unsuitable as a shade tree for coffee or cacao. In continuously humid localities, where the leaves are retained, shade trees are superfluous and the yield of rubber declines. The desirable features of shade culture, the shading of the soil, and the encouragement of tall upright trunks are to be secured by planting the rubber trees closer together, rather than by the use of special shade trees. Planting closer than 10 feet, however, is of very doubtful expediency. The percentage of rubber increases during the dry season and diminishes during the wet. The flow of milk is lessened in dry situations by inadequate water supply, but at the beginning of the rains such trees yield milk much more freely than those of continuously humid localities. The claim that more rubber is produced in the forests or by shaded trees seems to rest on tapping experiments made in the dry season.

"Continuous humidity being unnecessary, the culture of *Castilla* may be undertaken in more salubrious regions than those in which rubber production has been thought to be confined; the experimental planting of *Castilla* in Porto Rico and the Philippines becomes advisable, but extensive planting in untried conditions is hazardous. No satisfactory implement for tapping of *Castilla* trees has come into use. Boring and suction devices are excluded by the fact that the milk is contained in fine vertical tubes in the bark, which must be cut to allow the milk to escape.

"In British India it has been ascertained that the Para rubber tree may be repeatedly tapped on several successive or alternate days by renewing the wounds at the edges. The yield of milk increases for several tappings and the total is unexpectedly large. It is not yet known whether multiple tapping is practicable with *Castilla* or whether this new plan may not give the Para rubber tree a distinct cultural advantage over *Castilla*.

"The gathering of rubber from trees less than 8 years old is not likely to be advantageous; the expense of collecting will be relatively large, and the quality of such rubber is inferior, owing to the large percentage of resin. The rubber of *Castilla* is scarcely inferior to that of *Hevea*. The supposed inferiority is due to substances which can be removed from the milk by heat and by dilution with water." (India Rubber World, Vol. XXIX, No. 1, Oct., 1903, p. 3.)

"* * * No cultivated rubber has yet been produced in quantities in tropical Mexico. On the other hand, rubber trees have for some years been grown experimentally. These tests have already established two important facts: First, that conditions are favorable to the rapid growth of cultivated rubber plants, and second, that the rubber trees will yield marketable rubber. The general conditions favorable to the cultivation of rubber, namely, a well-drained soil without shade, have also been determined.

"From estimates obtained from various American planters in Mexico, the lowest yield for cultivated rubber trees at different stages is as follows:

"Average 6-year-old tree will produce without injury 4 to 6 ounces of rubber.

"Average 7-year-old tree bled to death will produce about 1 pound of rubber.

"Average 8 to 10 year-old tree will produce without injury at least 1 pound of rubber.

"The planting on the Rubio plantation in 1902 amounted to 1,499 acres, on which, allowing for failures, there are now estimated to be 1,600,000 plants. It is noted that the height of the trees grown from seeds—about 65 per cent of the whole—is greater than that of transplanted or replanted trees. The planting in 1903 amounted to 520 acres, on which, after again allowing for failures, there are 595,000 plants. The number of plants, of course, is much greater than will be allowed to stand permanently, but it has not yet been decided at what age to begin thinning out." (Report of the official inspector, Tehuantepec Rubber Culture Company, Mexico, India Rubber World, Vol. XXX, No. 2, May, 1904, p. 271.)

"* * * The hardiness of the *Castilloa elastica* tree simplifies its culture very much, and as it possesses a vitality superior to that of the weeds or of any other kind of vegetation, it does not require heavy expense for frequent weedings. If, without any help from man, such trees can grow for hundreds of years in wild woods full of vines, briers, and many other plants, under cultivation they can certainly outlive the weeds.

"* * * The time required to produce gum from this tree depends upon the locality, rainfall, and methods used for cultivation. My estimates of production and tapping age are based upon my personal experience and close observation, and not upon what others have written. The cultivated rubber tree blossoms after the sixth year, and can not be tapped before this time without injury. The rainfall of the previous year generally determines the earliness of the season and the number of the blooms, the quality of the seeds, and the flow and quality of the milk itself.

"The sap furnished by a 7-year-old rubber tree should yield a minimum of 1½ pounds of pure rubber, and as every tree increases its yield by no less than one-half pound of gum annually until its 25th year of age, at least 15 to 20 pounds of pure gum should be obtained yearly thereafter during the life of the tree. So an acre of land containing 220 rubber trees, planted 14 feet apart each way, will give at the end of the sixth year—or, to be more exact, in the first crop made during its seventh year of existence—330 pounds of pure rubber, which, at the rate of 50 cents gold, would give a revenue of $165. If this estimate of 1½ pounds per tree should not seem conservative enough, let it be 1 pound to the tree, and the return per acre will be $110." (Chas. G. Cano, C. E., Mexico. India Rubber World, Vol. XXIV, No. 5, August, 1901, p. 322.)

"An exact record was made of the results of some recent tapping of rubber trees (*Castilloa elastica*) on the San Miguel plantation, owned by the Tabasco Plantation Company, located on the Macuspana River, in the State of Tabasco, Mexico, which are summarized below. There are on this estate about 400 large rubber trees, which were planted in the shade of 'mother' trees (not rubber) planted for shading the coffee while the rubber was getting a start.

"The rubber trees on this plantation are of the variety known throughout Mexico and Central America as *Castilloa elastica.* This variety is divided into two classes, the first of which is known as the yellow rubber tree, *Hule amarillo*, this being the male. The milk from these trees flows very freely, having a fresh yellowish color. It flows so freely that there is scarcely any left in the cuts after tapping. The other variety is known as the white rubber tree, or *Hule blanco*, this being the female.

"A fact well known to the rubber planters is that trees planted in the shade require a much longer time to attain their maturity and full size than those planted in the sun. In fact, the most casual observer could not fail to notice the astonishing difference in size between the trees grown in the sun and those in the shade. It is believed that the size of a rubber tree has more to do with the amount of rubber it will produce than its age.

"The first step in tapping a rubber tree is to clean a small place around the tree, a small gash then being made in the bark with the point of a machete and a leaf inserted therein, which serves at a spout to run the milk into pails. From this point the cuts are made upward at an angle of 45 degrees and extending in each direction a sufficient distance to include three-fourths of the circumference of the tree. Directly above this, a distance of 1 meter, another cut is made exactly like the first, the milk flowing down the side of the tree into the first cut and on into the pail. These cuts are repeated on the entire body of the tree, or until the branches are encountered. You will at once see that all the milk has not been secured, but a sufficient amount left to maintain the tree in good condition for another year. The next tapping, which will be made a year from now, will be made on the same side of the tree, 3 inches above the cut made this year, and the following year 3 inches above that, so that it will be possible to make 13 tappings on one side, or 26 on both sides; or, in other words, a tree can be tapped twenty-six years without retapping the old cuts. The instrument used by the native is a machete, or long knife. The bark of a 10-year-old rubber tree is about three-fourths of an inch thick.

"The milk, gathered in pails, is taken to the rubber-drying house, where it may be converted into rubber through either of the following processes, both of which we have used:

"First, it is spread on a cement floor to a depth of three-fourths of an inch, this floor being so situated that the milk is constantly in contact with the sun's rays, thus drying very rapidly. After it is dry, the sheets are rolled up into convenient sizes for shipment.

"The second process is through coagulation with a native vine known as 'bejuco de necta.' During the coagulation the rubber is left porous, and as it contains more or less water, it is necessary to remove same by using a press. It requires more time to prepare rubber by the first process. The average shrinkage in converting milk into solid rubber is 2.3; or, in other words, 2.3 pounds of rubber milk will make 1 pound of rubber. I have personally attended to the tapping, and the figures given herein are absolutely correct.

Age.	Number of trees.	Average girth.	Latex.	Rubber.
		Inches.	*Ounces.*	*Ounces.*
7 years	257	30.80	11.80	9.30
8 years	14	37.75	20.70	14.25
9 years	7	40.14	21.23	18
10 years	4	43.25	26.75	17.50
12 years	21	50.50	40.50	28.90

"Based upon the above figures, the rubber product from an acre of land containing 200 trees, 7 years old, would be 112 pounds; at 8 years old, 174 pounds; at 9 years old, 240 pounds; and at 12 years old, 314 pounds." (India Rubber World, Vol. XXVII, No. 1, Apr., 1903, p. 225.)

THREE VARIETIES OF CASTILLOA.

"* * * In planting *Castilloa* it would appear that great care is required to make sure that the seeds or seedlings obtained are really those of the best variety of *Castilloa elastica.* It appears that there are at least three varieties of this *Castilloa*, which are respectively distinguished as *Castilloa alba*, *Castilloa negra*, and *Castilloa rubra.* There is not the slighest difference between these three varieties as regards the general form of the tree and its branches, and also the flowers and seeds are in all three apparently identical. The above descriptions refer to the color of the bark. The difference even there, however, is so small that it takes a practiced eye to recognize the different varieties. These differ, nevertheless, very greatly in their value to the rubber planter.

"*Alba.—Castilloa elastica alba* produces a thick creamy milk. It is the hardiest of all *Castilloa* trees, and suffers very little from the tapping operation. It also yields the greatest quantity of rubber. The bark of this variety is white, with a distinct yellowish or pinkish cast.

"*Negra.—Castilloa elastica negra* is characterized by a very rough, dark bark. It yields very rapidly a thin milk, producing a good rubber, but the tree in tapping easily bleeds to death.

"*Rubra.—Castilloa elastica rubra* has a reddish bark, which is very smooth, thin, and brittle, nor does it show the longitudinal furrows which are noticeable in the two first-named trees. This variety yields a very small quantity of milk, but the rubber obtained from it is good. The tree is very common all over Central America, and I am afraid that, in a number of instances, it was this tree which was planted instead of the white *Castilloa.* Indeed, Kosschney is inclined to think that it is this variety with which the experiments in the botanical gardens of Ceylon and Java were made, which gave such discouraging results." ("Castilloa: Its description, yield, etc.," by Dr. C. O. Weber. India Rubber Journal (London), Vol. XXVIII, No. 5, Aug., 1904, p. 229.)

CASTILLOA ELASTICA IN THE EAST.

The tree.—"The real *Castilloa elastica*, or one of the right species, appears to be grown in Ceylon. There are several indications that point to this. We have the peculiar type of great size, with its back covering of short brown hair, the so-called 'dimorphism' of the branches, which consist in the branches which start from the trunk in a downward slope at a certain point taking a turn to a horizontal and then upward direction, and the color of the bark seems correct. The result of tappings made to date in Ceylon prove conclusively that all the trees so far experimented on contain latex capable of coagulation and resultant good rubber, and the variety of *Castilloa* entirely devoid of latex, of which we have been warned, appears so far to be absent from Ceylon. It is impossible to say definitely at present that we have the very best variety of rubber-yielding *Castilloa elastica*, as so little is known on the subject, but that we have one of the well-yielding varieties I am convinced.

Where to grow Castilloa.—"Subject as all my remarks in this paper must be to the somewhat extreme limitation of our present knowledge of *Castilloa*, I advance with confidence the opinion that this species of rubber requires very deep soil, with the best of drainage, and of a rich, loamy character, and consider it speculative to a degree to plant it under less favorable conditions. We have ample evidence at the Henaratgoda Gardens, and to some extent at Peradeniya also, of the fact that in shallow or ill-drained soils *Castilloa* will not grow to pay, if it grows at all. One of two things will happen; either the young plants will refuse to come away at all; or, flourishing for a certain period which may extend for some years, it will eventually be checked in growth and become weakly, diseased, quite useless for rubber-collecting purposes, which will assuredly kill it outright if attempted.

"The elevation at which to grow *Castilloa* I would put at 1,000 to 1,500 feet. Tried at sea level, and in Kalutara at a little above sea level, it refuses to grow after reaching a height of some 10 or 15 feet. Up to this the young plant appears as healthy as in higher elevations, but the check is inevitable and the tree may as well then be cleared out as only cumbering the ground. I therefore take the desiderata for successful growth of *Castilloa*, in the East at any rate, to be:

"1. Rich, free soil of considerable depth, with good drainage.

"2. Elevation of from 1,000 to 1,500 feet, with some latitude at either end, but for perfection of growth I would favor about midway between the elevations given.

"The *Castilloa* root descends to great depths, and hence the necessity for deep soil, for I take it the 'tap' root here is of much importance in relation to the latex-bearing powers of the tree.

"As regards situation and lay of land, I would favor undulating ground, but attach no particular importance to this. The *Castilloa* is a very robust tree and survives serious injury, so that it may be planted, even where subject to much wind, though this will to some extent retard the growth. For reasons given later in this pamphlet, the best conditions of climate for the growth of *Castilloa* and its success as a revenue-earning power would appear to be where wet and dry seasons alternate in well-marked divisions. A constantly humid climate, such as would suit Para, is not desirable. *Castilloa* likes drought, and I have seen it at the end of three months without rain in as healthy and luxuriant a state as can be desired. *Castilloa*, where conditions are favorable, is a tree of very rapid growth, reaching in three or four years' time to a height of some 30 feet, with a girth of 25–30 inches. These are actual measurements taken in Ceylon.

"*The seed of nurseries and planting.*—The seed of the *Castilloa* tree was at one time considered to be very perishable indeed, but experience has proved this is not the case, and packed in charcoal it may be sent long distances with safety. It is important, however, that the seed be extracted from its red fleshy covering the same day as picked and at once properly cleaned. Treated thus, as an experiment in planting, seed two months after picking resulted in an outturn of 80 per cent. It is essentially a hardy seed, and where the product of the trees is grown under the favorable conditions I have enumerated above, a very large percentage of plants from the seed laid down may be counted on with confidence. I emphasize this point, as it is of very much more importance to success than that usually laid stress upon by intending purchasers who inquire, 'What is the age of the parent tree?'

"In my own experience I have known of two cases, in one of which the parent trees are from 12 to (it is believed) 20 years of age, and the other 4 years only. The former gave a very poor out-turn of plants from seed, whereas with the latter the out-turn was practically 100 per cent, or no vacancies, and the plants most healthy. I see no reason for this but the fact that the older tree was grown in ill-drained land near a sluggish stream, as against in the other case, ideal conditions of soil and drainage. Early seeding in *Castilloa* is no sign of weakness, as would be the case with many species of trees, but, on the contrary, a sign of vigorous growth.

"The seed is small, being about half the size of a filbert, and is contained in a white, papery coat. It should be well dried before dispatch. The planting in the nurseries should be in baskets under shade, good loamy earth being used. Squirrels are fond of the young plants and nip off the roots to some extent, but this by no means kills the plant attached, which grows up again from below. The planting out can be done when a height of from 4 to 6 inches is reached.

"If care is taken to plant deep in the clearing with earth well up the stems, there will be very few vacancies and any plants that apparently die back will in most cases send up a fresh shoot from the roots. It is not necessary to cadjan shade; the young plant has been found to come on regularly and well without this expense being incurred. In my own experience dap-dap or some fast-growing shade has been planted at the same time as rubbers, but I am not convinced that this is necessary, though useful as a means of keeping down weeds, to the influence of which *Castilloa* is very susceptible. Too dense shade has the result of keeping back the plants or inducing whippy growth as they reach up to the light, whereas in the open the young trees come on well. At the present time and with what experience we have I would advocate the planting of shade trees, say 20 by 20. Unlike the Para variety, the *Castilloa* does not appear to be as tempting a morsel to porcupines and cattle; some damage is done, but not much. Cocoa seems to come well, if planted at the same time as rubber, and personally I see no reason why it should not continue to flourish and to give good crops. The shade of *Castilloa* is not too dense, and being a deep feeder its roots should be well below those of the cocoa. There is considerable litter from the dropping of the large leaves peculiar to this tree, and this must assist to enrich the soil to some extent." ("*Castilloa elastica* in the East," by W. E. G. India Rubber Journal (London), Vol. XXVIII, No. 9, Oct., 1904, p. 418.)

PARA RUBBER.

"The greatest rubber-producing country of the world is the Amazon Valley, embracing many thousands of square miles of rubber forests in Brazil, Boliva, and Peru. The center of the industry is the city of Para, whence the name 'Para rubber.'

"Although chemically there is little difference between samples of rubber from various species of trees, still it is a well-known fact that Para rubber obtained from the tree *Hevea brasiliensis* is recognized as the standard for grading commercial rubbers.

"At Para rubber is classified into three grades, known in the United States as fine, medium, and coarse. The difference in these grades is governed largely by amount of transparency and care in preparation for the market." (All About Rubber, compiled by J. Ferguson, 3d ed.)

PARA RUBBER (HEVEA BRASILIENSIS).

Federated Malay States—"The latest annual report of the United Planters' Association of the Federated Malay States devotes special attention to the cultivation of Para rubber, which continues uppermost in the interest of the planters in that region. A favorable rate of growth is reported and the absence of pests and diseases among the trees. The year covered by the report was the first in which tapping had been done on a large scale, and the result was a better yield from the young trees than had been expected, and the prices realized equal to if not better than those for the finest of rubber from Ceylon. More new rubber estates were opened than in any former year, and the extension of rubber acreage on the old estates was also larger. The total acreage planted with rubber in the Far East is estimated in the report as follows:

Federated Malay States and the remainder of the Malay Peninsula	30,000
Sumatra	5,000
Java	5,000
Ceylon	25,000
India and Burma	5,000
Total	70,000

"The report says: 'We will take it for granted that this 70,000 acres is all good and that it will give a good yield of 200 pounds per acre—14,000,000 pounds. This can not all be in full bearing until the end of 1911, and no more than this 70,000 acres can be in bearing at the end of 1911, for it is not planted.'

"In view of the growing demand for rubber, while the exports from Para remain practically constant, the report takes the position that there is no reason to fear overproduction of rubber, since even the maximum output of Asia by 1911 would be hardly more than 10 per cent of the present world's consumption; but even if rubber should be overproduced some day, it is felt that Brazil can not compete with Asia with rubber at 2s. 6d. per pound, at which price Straits and Ceylon rubber can be sold at a profit." (India Rubber World, Vol. XXXII, No. 5, Aug., 1905, p. 377.)

"A rubber tree from Para seed in the Waterfall Botanic Garden, Penang (Malay States), now 17 years old, has had seven tappings, beginning in June, 1897, the total yield from which, in dry rubber, is herewith stated in detail, as reported by Mr. C. Curtis, superintendent of the garden, to the Straits Agricultural Bulletin. The aggregate is 18 pounds 7¼ ounces, an average per tapping of 2 pounds 10.18 ounces, or an average per year of 3 pounds 1.21 ounces. The system of tapping is thus described: A small perpendicular channel is cut in the bark about a foot in length and one-eighth inch broad, but not deep enough to obtain much latex, its object being merely to conduct the latex to a tin receptacle fastened at the base. This channel is not subsequently enlarged or interfered with. Two or three incisions are then cut on either side, leading obliquely to this channel to supply the latex. From the upper side of each of these a thin shaving of bark is removed every morning, or on alternate mornings, which causes a fresh flowing of latex. In each of these seven tappings a thin shaving has been removed thirteen times, which with the initial cutting makes fourteen operations, the whole constituting what Mr. Curtis calls 'one tapping.' Thus the times this tree has been operated upon is 7×14, equaling 98, and the average amount of dry rubber from each operation about 3 ounces. The daily amount, however, varies very much, the yield from the first two or three operations each season being almost nil. No attempt was made until the last tapping to save such rubber as may have been removed with the shavings of bark referred to, and this, Mr. Curtis thinks, would be an important item on a large plantation. A plain carpenter's chisel is considered better than a special tapping tool sent to Mr. Curtis, because a finer edge can be kept on it, and the sharper the implement the better the flow and the less the loss by coagulation in the cuts.

"This tree resulted from a tree planted in the Singapore Botanic Garden in 1885, and was one of a dozen transplanted in Penang early in 1886. It was selected for the series of tapping experiments on account of being the largest in the group.

"'It is not pretended that the results of tapping the tree is of great value as a guide to the results to be obtained from a large number, for we now know,' says Superintendent Curtis, 'that there is a great dissimilarity in the yield of trees of equal size growing side by side under exactly similar conditions. The interest in this particular tree, then, is that it has been tapped six times, * * * that it shows no sign of deterioration, that the incisions made are all healed up, and that the total yield of dry rubber during the period is stated.'" (India Rubber World, Vol. XXVII, No. 4, January, 1903, p. 11.)

TAPPING PARA RUBBER TREES, PERAK, TAIPING.

"In the annual report for 1901 on the government gardens and plantations of Perak, Taiping, Superintendent Robert Derry records his experiments in tapping Para rubber trees. The method adopted involves a vertical incision in the bark, extending from the base some 4 feet up the trunk, with 5 oblique branch incisions on each side. Mr. Derry tapped two trees, making three sets of incisions in each, each set extending over something less than one-third of the circumference of the tree, and compared the result with that from a tree cut with only one set of incisions. He is of the opinion that very little more rubber is obtained from the extensive tapping. The yield of rubber from the first two trees, of the same age and size, was 28¼ and 26⅙ ounces, respectively, while from a single set of incisions in a tree slightly older and larger, 32¾ ounces of rubber were obtained. The tapping was done in September last, the same incisions being reopened day after day, in the case of the first two trees eleven times, and in the case of the third tree eight times. Two of the trees, 10 years old, were 17 and 18 inches in diameter, respectively, 3 feet from the ground, and the third, 14 years old, was 20 inches.

"Thirty-two Para rubber trees in the Taiping garden, about 12 years old, yielded 125 pounds of dry rubber, or an average of 3.9 pounds each. It appears that the best season for tapping is between June and November. The latex seems to exude most freely in wet weather, the occurrence of which varies in different years." (India Rubber World, Vol. XXVII, No. 1, October, 1902, p. 16.)

THE CULTIVATION AND PREPARATION OF PARA RUBBER.

[By W. H. Johnson. A Book Review.]

The book opens with a general introduction on the subject of rubber. Referring to Para, the author states:

"It is estimated that there are about 12,000 acres planted with this tree in Ceylon, while in the Malay Peninsula there is a still larger area under Para-rubber cultivation. The small amount of cultural skill required to successfully plant and cultivate Para rubber, coupled with the high prices paid for the rubber which the cultivated tree produces, in comparison with that paid for other grades of rubber, has no doubt largely influenced planters in selecting the Para tree in preference to other rubber-producing plants.

"The province of Para, from which the product of this tree derives its name, is situated south latitude 1°. It is reputed to enjoy a remarkably uniform climate, with a mean temperature of 81° F., but a very moist atmosphere, and an annual rainfall varying from 60 to 90 inches.

"The tree has adapted itself to various climatic influences, and in the Gold Coast, West Africa, this tree, grown in experimental plots in the Botanic Garden, Aburi, which is situated 1,500 feet above sea level, and where the average mean temperature is about 81.5° F. and the annual rainfall 47 inches, promises better than any other rubber-producing plant, indigenous or exotic. It is likewise favorably reported upon in India, Jamaica, Dominica, St. Vincent, Grenada, Trinidad, Zanzibar, Uganda, and Mozambique.

"An experiment in packing was carried out by the Gold Coast Botanic Gardens last year, with a view to ascertain the better method for packing seeds sent from the Orient to West Africa, viz, packed with moist soil in Wardian cases, or with charcoal and sawdust in ordinary cases. Twenty thousand seeds, packed by the first-mentioned method at the Royal Botanic Gardens, Ceylon, arrived at the Tarkwa Botanic Station, Gold Coast, in November, 1903, and from these 3,400 plants have been raised; while from 30,000 seeds packed with charcoal and sawdust in ordinary cases, sent at the same time, 3,650 plants have been raised.

"Sowing the seed in bamboo pots is perhaps most satisfactory, for by this method the roots of the plants are not as much disturbed when they are transferred to the plantation as in the case where they are lifted from the nursery beds; while if seeds are sown out direct in the plantation and a spell of dry weather follows, a large number will fail to germinate. When large numbers of plants are to be raised, it is advisable to select a well-sheltered spot, possessing a rich, light, friable soil, and near the site for the plantation. On this, temporary nursery shelter should be constructed by fixing stout upright posts about 8 feet high, in lines 10 feet apart each way, and then on these cross bars—the whole sufficiently strong to support a thin layer of palm leaves, split bamboo, or some other similar material. Under this the bamboo pots should be placed.

"Bamboo pots are manufactured by sawing up bamboo into sections about 1 foot long. The bottom of the pot is formed by sawing one end of it off about an inch below an internode or division of the pole, a hole being made in the division to allow the water to drain away. A few rough stones should be placed over the hole to prevent fine soil filtering through, and the pot filled within 2 inches of the top with light, friable soil. Provided the vitality of the seed is good, one seed is sufficient to sow in each pot, and this should be placed on the soil in the pots prepared in the manner above described, and then covered with about an inch of soil. After the seeds germinate and the pots become filled with roots, more frequent waterings will be necessary. If the plants suffer from lack of water at this period, they are liable to receive a severe shock to their proper development." (India Rubber Journal (London), Vol. XXVIII, No. 12, November, 1904, p. 518.)

PARA RUBBER IN CEYLON.

[A complete account of its preparation, cultivation, etc., by Francis J. Holloway.]

"For some years the impression in Ceylon was that Para rubber would only grow in low-lying lands up to an elevation of 500 feet, and requiring more or less swampy flats. The results obtained have dissolved these theories, and now prove that Para rubber will yield in paying quantities on different soils, on hillsides up to 2,700 feet elevation. It is still an open question whether it will pay at a higher elevation than 2,700 feet. It seems to grow well on moist soils, even on a gravelly quartz, but of course it is a different thing whether it yields a paying quantity of latex.

"The only soil I found it would not yield anything on is a blue sandy soil, with more or less sandstones below the surface. In one instance I found a fine large 12-year-old tree growing on a pure blue sand, and on digging a hole beside it, I found 4 feet of sand, and then a damp, clayey undersoil, which accounts for the tree growing through a structure of sand, and yet looking healthy and large and yielding well. It is true that it grows faster at an elevation of 500 feet, but I much prefer an elevation of 1,000 feet to 1,500 feet, as on tapping the latex, especially in the hot weather, it does not stop flowing as soon at the higher elevation; and as to yield, tree for tree, at the second elevation, of similar ages, there is nothing to choose.

"Para should only be planted on fairly good soil. It will not do very well in very stiff soil. The temperature best suited for the cultivation lies between 74° and 94° F., and the rainfall over 80 inches to 150 inches.

"Now we come to a much-disputed point—how far apart to plant. Some recommend close planting, others distant. My experience leads me to recommend about 15 feet by 15 feet apart, giving about 200 trees to the acre. I have seen rubber planted 30 feet by 30 feet, and 40 feet by 40 feet, but from results obtained in tapping, there is nothing like the extra quantity of rubber from trees planted far apart to make up for the poorer growth of close planting. Trees planted at 30 feet by 30 feet grow much faster, but 30 feet by 30 feet would only give about 4 pounds per tree in their ninth year to equal the 1 pound per tree planted 15 feet by 15 feet. This they certainly do not, but have given 1½ pounds against the 1 pound of close planting.

"Therefore, I certainly do not recommend distant planting, unless you wish to grow some other product as well, such as cocoa, and then a good distance to plant would be 30 feet by 15 feet, or even 30 feet by 30 feet, with no other shade planted.

"It will not pay to plant rubber any closer than 15 feet by 15 feet, for the trees would grow very weedy and give every inducement for canker fungus. Holes should be cut about 2 feet by 1½ feet, and filled with the top soil scraped from around the hole. Holes should be filled as soon after burning as possible in order to get the full benefit of the potash, etc.

"It is scarcely possible to tell good seed from outward appearance, as there is nothing to judge the soundness unless it is absolutely light, which can be felt by weight. Even if soaked in water, one can not tell a good from a bad seed. The only way to strike an average is to take a few seeds out of each bag on arrival and break them open and then take the average. Seed can not be sent on long journeys unless carefully packed, as they lose their vitality very soon. They can be sent on short journeys up to five days simply put in a bag. I have found packing them in damp powdered charcoal a very good way, and put up in this manner they keep up to one month, 75 per cent of them turning out sound and mostly germinating.

"From experiments made in packing in damp charcoal, and opening the boxes at periods of one, two, three, or four weeks, the results are very satisfactory. After four weeks the seed begins to grow too much to stand any longer 'imprisonment' and gets so crooked and entangled one into the other that they form on the top part of the box inside a perfect mass of roots, etc. Seed should be washed in a solution of sulphite of copper and water just before packing. In ten days seeds are above ground, and in twenty days they are nearly 10 inches in height. About 5,000 seeds is nearly 50 pounds. Usually the seed is dispatched for local sale in bags of 5,000, which just weigh 50 pounds—one coolie load. A fresh seed has a very oily feeling outside, and when the seed has fallen off the tree for a few days this oily, smooth feeling disappears and the outer covering gets a dark-brown color and is rough to the touch. The seeds hang in clusters of three in one; each is divided from the other by a hard shell about one-sixteenth of an inch thick.

"About February the blossom appears and has a very sweet smell, reminding one of 'Lankas spicy breezes,' and the buzz of the bees can be distinctly heard all day long as one walks underneath. About the 28th of July the first seeds begin to ripen. The outer shells are perfectly green when unripe and become quite brown when ripe. If it happens to be wet at the time the seed is ripe, not a single one will fall down until the sun appears, and then shortly after a few hours' sunshine you can hear crash, crash, crash, all over the place, especially if there is any iron roofing close at hand. They make quite a noise when they burst open the shell and fall down—on a fine night, after a hot day's sun, they will fall all the night through.

NURSERIES AND PLANTING.

"A good piece of land should be selected for the nursery, fairly flat and with water at hand. First, the jungle growth should be cut down, and, when thoroughly dry, set fire to, to get a good, even fire. This will kill all the insects, etc., and at the same time benefit the soil.

"Secondly, the whole plot should be well turned over to a depth of about 15 inches, and all stumps, roots, and stones taken out and other lumps broken up and made fairly smooth. The plot should then be divided into beds, say about 20 feet by 4 feet, with a drain in between. This drain should be about 1 foot deep and wide. After this the beds should be smoothed off and made ready for the seed. Coolies, armed with small stakes about as thick as the thumb and silghtly pointed, press this tool into the soil about 6 inches apart and just deep enough to put the seed in, and then cover it with soil for about one-half inch. The best way of laying the seed is on its side, as it is not easy to see the germ and it should be laid thus and the root will work down into the soil and leave the shoot to grow upward.

"If plenty of good nursery land is available, the farther apart the seed is planted the better the growth of the plant up to 1 foot by 1 foot. Seed planted 6 inches by 6 inches should grow to an average height of 6 feet in ten months. I have known trees planted in a prepared hole with manure to grow 10 feet in twelve months. The nursery should be well protected, as the young plants are attacked by all kinds of insects and animals, especially rats, which burrow beneath the roots and bite off the shoots under the surface; but, on the whole, the damage done is very small. Nurseries should be most carefully protected from the sun by putting on a good cover about 2 feet above bed, as the germination of the seed will depend on the care taken of them during the first ten days. They should be well watered twice daily. At the end of a month the cover of the nurseries should be gradually taken off. By the end of two months no shade is required and the plants will grow all the better in the open sunshine. Rubber plants after two months in the nurseries do not require any shade, and I have seen whole nurseries badly affected by allowing the cover to remain on.

"If plants are put out, first the prepared hole should be slightly trampled upon, and then a stake about as thick as the thumb and 3 feet long forced into the center of the prepared hole and staked round; the plant put in carefully to the same depth as it was in nursery and the soil pressed against the tap root by pushing the stick into the hole somewhat at an angle and pressing toward the plant and trampled round with the naked foot. Great care should be taken that the tap root is put in straight, and not curled up, as probably the yield of the tree will depend mostly on the depth of the tap root.

"If the estate is kept free from all weeds, etc., few pests will trouble the young plants. Wild animals, such as the pig and porcupine, and even the hare, will attack the plants, but to no great exent if well looked after. Plants require care until they are about 6 feet in height, and then they grow on without much trouble. Near the edge of the jungle, a good plan is to tar the lower 2 feet of all plants, as porcupines, etc., will not touch them if this is done now and again." (India Rubber Journal (London), Vol. XXVII, No. 10, May, 1904, p. 471.)

PARA RUBBER TAPPING, CULLODEN, CEYLON.

"The plantation Culloden, Ceylon, is primarily for tea, the rubber having been planted later through the tea and also in some of the valleys. The land is very rocky, ironstone abounding, but there must be something in the soil that suits the *Hevea*, for it flourished wonderfully. The only place where it did not appear to do well was in very low ground, where there was no drainage. The swampy portions of the land have, therefore, been thoroughly drained; indeed, where some of the 7 and 8 year old rubber now is there had once been a bog where cattle were wont to get mired. The rubber on this soil, which was very rich, had some 3 feet of drainage.

"* * * The tapping of the trees begins just as soon as it is light in the morning, for through the middle of the day the latex does not flow freely but starts up again about 4 in the afternoon and is continued until dark. The trees are tapped when they show a girth of 2 feet, without regard to their age. No ladders or supports are used in tapping as it was not found profitable to tap higher than a coolie can reach while standing on the ground. The tool is a very simple V-shaped knife with two cutting edges and a single slanting cut about 8 inches long has been found to be best, a tin cup being placed under the lower end of the cut and held in position by forcing its sharp edge under the bark. These cuts, by the way, are about a foot apart, sometimes closer, and all run in the same direction, the herring-bone and V-shaped cuts being no more in evidence. The practice is also followed now of cutting a very thin shaving from one side of the cut every other day, 11 times; in other words, reopening instead of tapping. Before placing the tin cup under the cut it is rinsed out in cold water to keep the latex from adhering to the tin and also to keep it from too quick a coagulation.

"While I was there a very interesting experiment in scraping the outer bark from the trees had just been finished. The results, as far as could be determined, were such a stimulation to the lactiferous ducts that the flow was increased nearly 50 per cent. The oldest trees on this plantation, by the way, are 18 years, and have produced 3 pounds a year; by scraping the outer bark off they expect to get 6 pounds a year from each of these. There are only a few of these older trees, however, most of them being 7 or 8 years of age.

"All through the rubber orchards on this estate were hundreds of young Para trees that were self-sown; indeed, in many places they had come up so quickly as to be a nuisance.

"* * * After many experiments, the manager at Culloden has satisfied himself that only the very early morning or late afternoon are the proper times to tap, as in the middle of the day the flow of latex is almost nothing. The trees are therefore tapped from 4 until 7 a. m., and after 3.30 p. m., and as long as it is light." (Report of a visit to the india-rubber plantations of Ceylon by the editor of The India Rubber World, Vol. XXX, No. 4, July, 1904, p. 335.)

HEVEA RUBBER CULTIVATION, TAPPING, ETC.

"The *Hevea* certainly dislikes wind and flourishes best in sheltered positions. It seems to grow in the roughest, rockiest positions, and to be quite at home among rocks and bowlders in the old beds of mountain torrents. The plants are raised from seed which freely germinated sown in beds in the nurseries raised about 3 feet, and about 4 to 6 feet wide. The plants are generally put out in holes, dug in lines amongst the tea or in special rubber plantations, and when about a year old are known as 'stumps.'

THE TAPPING OPERATION.

"The age at which tapping should be commenced is now generally considered to be 7 years. Rubber-producing latex is yielded some time before this, but the strain on the young tree, coupled with the fact that the maturer trees' latex is far richer in rubber, make the older age preferable. The bark of the tree is rough and thick, and before tapping is commenced the outer bark must be shaved off. There are several reasons for this.

SHAVING OF THE TRUNK.

"With the rough bark on, it is more difficult to make a proper incision for tapping and harder to fix the cups. If tapping were carried out on unshaven trees, much latex would be lost on the dirty bark, or only result in 'dirty scrap.' But the main reason for shaving is that it increases the flow of latex. The exact use of the latex to the tree is not yet known, but the result of shaving indicates that one of its uses is to heal up wounds and renew bark. For some reason or other, the shaving greatly increases the quantity of latex in the tissues immediately below the shaved portion, and this result is found even if only a small portion of the trunk is shaved. Shaving seems to have an irritating influence on the latex, drawing a great quantity of it into the laticiferous cells immediately above the shaved portion. The tree to be tapped is shaved over the tapping surface about two weeks before tapping is to commence. On some estates the whole trunk, from base to some 6 feet up, is shaved; other planters hold that it is better to shave just those parts where the incisions are to be made; but this, of course, depends to some extent upon the system of tapping to be adopted, and is a subject for much experiment.

VARIOUS TAPPING METHODS.

"V-shaped cuts are in favor, as D in figure 1. The cuts are about 8 to 10 inches in length, and this method is highly recommended by Monsignor Collet. The herring-bone system seems not to be in favor in Ceylon, a series of small V cuts being given the preference (see B in fig. 1). Another kind of cut seen on one estate is a twisted cut starting at a point and half encircling the tree, being in all about 24 inches long (as C in fig. 1), but this plan of tapping is not continued. On two estates, leading rubber estates, the method adopted is what, for want of a better name, I will term the 'zigzag' system (E in fig. 1). It consists of a cut 6 inches long, at angle of 45° with the perpendicular, then a vertical cut of 2 inches, and then another of 6 inches cut parallel to the first. A series of these cuts is made down the tree, the initial point of each cut being on a level with the final point of the cut above. For the second day's work a fresh cut is not made, but the lower side of each 6-inch cut is simply pared with a gouge. By those who use this method it is greatly recommended, and the results obtained certainly seem good. This paring of the lower side of the cut, instead of a new incision, might well be extended to other methods of tapping also, and seems to be economical in taxing the bark-renewing resources of the tree, while the flow of latex from the pared portion is first rate. On the accompanying diagram (which is not exactly drawn to scale) the various methods of tapping referred to are represented, and also a method highly recommended by Monsignor Collet. This is a series of cuts in four, each about 4 inches long; the first cut one day, the next a little distance below, followed by more series until the base of the tapping area is reached; then another series of forms is begun parallel to the first one, and so on.

A GERMAN CONGRESS DISCUSSES RUBBER.

"At the second German Colonial Congress (Berlin, October 4–8) a considerable part of the programme was devoted to the consideration of topics connected with caoutchouc and the world's supply of this important commodity. * * *

"The question of the eventual overproduction of rubber was next touched on by the speaker as a matter of practical interest in connection with engaging in its culture. He quoted figures to show that at present some 60,000 hectares (148,260 acres) were devoted to rubber plantations, of which 16,000 are in Ceylon, 15,000 in the Malay states, and 4,000 in Mexico. Should the yield be only 1,000 marks per hectare (at present a net profit of twice this sum is calculated on plantations of *Hevea*), within a few years a harvest would be valued at 60,000,000 marks ($14,280,000); or, if we figure the annual yield per hectare at an average of 200 to 250 kilograms of rubber, the 60,000 hectares would yield 12,000 to 15,000 tons of caoutchouc, equal to about 20 per cent of the world's total present production. It must be considered, however, that the production of wild rubber will decrease rather than increase, especially if prices should decline. At the same time a fall in prices would lead to increase in consumption. Therefore the overproduction of caoutchouc is not to be feared for a long time to come.

* * *

"The speaker urged participation in rubber-planting undertakings. Hesitation, he said, meant a serious loss to the national capital in the colonies, and every ton of rubber obtained in their own colonies was a material gain to the Empire in enhancing its independence of other countries. He solicited earnest support for the Kolonial-Wirtschaftlichen Komitees, which has endeavored to further rubber culture in colonial Germany, and is now preparing to send a caoutchouc and gutta-percha expedition to New Guinea. He touched upon the importance of granting valid titles to colonial lands for planting purposes as a further incentive to capitalists to interest themselves in rubber culture. He regretted that this culture had not started in the German colonies twenty years ago, in which event rubber prices might not be so high to-day, and certain recent failures of rubber factories might have been averted.

"In the ensuing discussion, further proofs were offered of the profits to be expected from rubber planting. Attacks were made, however, on the newly organized Samoa-Kautschuk Compagnie, which was accused of giving rise to too high expectations of profits. In the absence of a representative of the company, Doctor Warburg arose in its defense. He said it was surprising with what energy and intelligence this company had begun operations in securing 400,000 young plants of *Hevea brasiliensis* in Wardian cases and 700,000 seeds in various packings, for shipment from Ceylon and Malacca to the new plantation." (From India Rubber World, Dec. 1, 1905.)

"* * * The qualities vary, even from the same estate, according to the age of the trees, while yet so young. We judge that the rubber has not attained its full strength till the tree is at least 8 or 9 years old; younger than that, though good gum, it has not the strength of hard cure Madeira fine Para, and is uneven in strength. There is no difference noticeable in the rubber tree from 8-year-old trees from different plantations. We have used about 4 to 5 tons in testing it from about 20 plantations. As yet it is not safe to use for the finest work, such as india-rubber thread and the best bladders, but where a 'weak Para' will do, it is all right." (From India Rubber World, Dec. 1, 1905. By P. J. Burgess, public rubber expert, F. M. S.)

COPIES OF LETTERS REGARDING PARA RUBBER SEEDS.

AMERICAN CONSULATE-GENERAL,
Singapore, S. S., December 23, 1904.

SIR: I have the honor to inclose herewith copy of letter from Mr. W. Dunman, of this city, as to prices of Para-rubber seed. Mr. Dunman is a practical planter and is here an admitted authority on rubber culture.

I have the honor to be, sir, your obedient servant,

O. F. WILLIAMS, *American Consul-General.*

The Hon. DEAN WORCESTER,
Secretary of the Interior, Manila, P. I.

SINGAPORE, *December 19, 1904.*

DEAR SIR: I have made arrangements with some of the leading planters in the F. M. S. for the supply of Para-rubber seed, and am in a position to supply selected seed from trees 5 years and over at $5.50 (silver) per 1,000, packed in boxes of 50,000 in dry pounded charcoal, delivered in Singapore.

The season is between August and November.

As there is a considerable demand, it would be as well to book orders as soon as possible, and I am prepared to do this for the next five years.

I am, dear sir, yours, faithfully,

W. DUNMAN.

O. F. WILLIAMS, Esq.,
United States Consul, Present.

SINGAPORE, *March 28, 1905.*

SIR: I have the honor to acknowledge the receipt of your order for 5,000 Para seed.

As the Para trees appear to be fruiting earlier than usual, I hope to be able to dispatch the lot in May or June. * * *

I have the honor to be, sir, your obedient servant,

W. DUNMAN.

Capt. GEORGE P. AHERN,
Chief, Bureau of Forestry, Manila.

SINGAPORE, *July 6, 1905.*

SIR: I have the honor to acknowledge the receipt of your letter of the 23d ultimo in regard to Para-rubber seed.

I have to report that the Para trees all over the Peninsula are uncommonly short of crop this year, and, in addition to this, the crop will be later than usual.

You may rest assured that your order will be sent forward as soon as ever the seeds ripen and are procurable.

I have the honor to be, sir, your obedient servant,

DUNMAN & PICKERING.

Capt. GEORGE P. AHERN,
Chief, Bureau of Forestry, Manila.

SINGAPORE, *September 29, 1905.*

DEAR SIR: I have to advise you that I am shipping per steamship *Isla de Luzon*, leaving this 15th of October, 5,000 Para seed, which is carefully selected and packed, either in charcoal or sawdust. Please see that they are planted out into nursery at once or they will not germinate.

I find that similar seed sent to Java resulted in about 60 per cent germinating. Should you want further seed this season, you will have to let me know promptly.

I am, dear sir, yours, faithfully,

W. DUNMAN.

The season has been abnormally late this year.

Capt. GEORGE P. AHERN,
Forestry Bureau, Manila.

SINGAPORE, *October 14, 1905.*

SIR: I have the honor to advise the shipment to-day, per bearer, of two cases of Para-rubber seed, and have drawn on your Government for cost at Ex. 106—₱31.80. The documents are in the hands of the Chartered Bank.

Please see that delivery is promptly taken of the seed, and that same is planted without delay, as they go off very quickly. About 60 per cent should germinate.

Large quantities of seeds have been exported this month at very high prices (about $12). The season was very late, which accounts for the delay.

Trusting you will get satisfactory results and that you will be sending me large orders,

I am, sir, yours, faithfully, W. DUNMAN.

Capt. GEORGE P. AHERN,
Chief, Bureau of Forestry, Manila.

LETTER TO A. DETERMANN.

DEPARTMENT OF THE INTERIOR, BUREAU OF FORESTRY,
Manila, P. I., February 19, 1906.

Mr. A. DETERMANN,
Baer Senior & Co.'s Successors, Manila, P. I.

SIR: I have the honor to acknowledge receipt of your letter of the 14th instant, requesting information concerning privileges to extract rubber and gutta-percha, timber, and other forest products from public lands in the Philippine Islands as follows:

Attention is invited to the following sections of the forest act:

"SEC. 13. The chief of the bureau of forestry, with the approval of the secretary of the interior, may, as herein provided, issue licenses for the cutting, collection, and removal of timber, firewood, gums, resins, and other forest products from the public forests and forest reserves. Every license so issued shall specify in detail the rights to which it entitles the holder and shall provide, whenever practicable, for exclusive territory in similar products to each licensee. All licenses for timber shall provide for the selection of said timber before cutting: *Provided,* That when absolutely necessary the selection of timber or the granting of exclusive territory may, in the discretion of the chief of the bureau of forestry, be omitted in any license terminating not later than June thirtieth, nineteen hundred and eight, after which date the selection of timber and the granting of exclusive territory, whenever practicable, shall be required.

"SEC. 14. No license granted under the provisions of this act shall continue in force for more than twenty years. The chief of the bureau of forestry, with the approval of the secretary of the interior, may, in granting any exclusive license, prescribe such terms, conditions, and limitations, not inconsistent with the provisions of this act, including a minimum amount of timber to be cut within a specified period or periods of time, as may be deemed by the chief of the bureau of forestry and secretary of the interior to be in the public interest and may provide in such licenses for forfeiture thereof in case of violation of such terms, conditions, or limitations.

"SEC. 26. Whenever an exclusive license of any class shall have been issued to any person, company, corporation, or other association for the cutting or removing from the public forest or forest reserves, of timber, firewood, or other forest products, stone, or earth, it shall be unlawful for any other person, company, corporation, or association, while such license is in force, to enter or operate within the territory covered by such exclusive license contrary to the terms thereof: *Provided,* That the residents within or adjacent to said territory may be permitted to cut or remove timber, firewood, other forest products, stone, or earth for domestic purposes.

"If, contrary to the provisions of this section, any person, company, corporation, or other association shall enter upon, and shall cut or remove, or attempt to cut or remove, timber, firewood, other forest products, stone, or earth, said property so attempted to be cut or removed shall be seized as government property by the local forest official or other representative of the forestry bureau, and the person making the seizure shall promptly notify the holder of the exclusive license affected thereby, and the said property so seized shall be surrendered to him upon the payment of the proper government charges thereon. Should, however, acceptance of said property and the payment of the charges thereon be refused, it shall be disposed of in the manner provided in section thirty-two of this act for the disposition of forest products, stone, or earth upon which the government charges have not been paid, and the proceeds turned over to the proper official to whom the government charges thereon should have been paid.''

No charge is made for any class of license issued by this bureau. Government charges on forest products are imposed after said products are gathered, as prescribed in the forest act. In Mindanao the charges on timber per cubic meter range from 50 centavos up to ₱2.50, depending upon the class of timber taken. Native woods are divided into four groups. The charges on firewood are as follows: Ten centavos per cubic meter for small pieces less than 60 centimeters in length and 7 centimeters in diameter. Larger pieces of firewood are known as "rajas." They range in size from 60 centimeters to 1½ meters in length and from 7 to 15 centimeters in diameter. One peso is charged for each 1,000 rajas.

On all gums, resins, and other forest products a charge of 10 per cent on the actual market value at the place where gathered is charged.

At Cotabato, Mindanao, where a large porportion of the gutta-percha is brought to market, the price per picul of 139½ pounds is fixed at ₱70, on which the government collects 10 per cent, or ₱7 per picul. At times as much as ₱2,000 per month was collected on gutta-percha alone in this town. Very little rubber has been brought to market at this point.

All but two licenses granted by this bureau expire at the end of each fiscal year, June 30. Two licenses are for twenty years; one is for a tract in Mindoro Island and the other in the province of Occidental Negros.

A few months ago, when the last leader of hostile Moros was killed in the Rio Grande Valley near Cotabato, a number of applications for licenses to gather rubber and gutta-percha were sent in by Chinamen who were located in the town of Cotabato. These applications were not granted for the reason that this office does not wish the present methods of extracting rubber and gutta-percha to be continued. The gutta-percha trees are felled before the latex is extracted. This destructive practice would, within a few years, destroy all of the large gutta-percha trees of this valley. Recently several of the leading Moro chiefs in Mindanao have expressed a desire to assist in teaching the natives the proper methods of extracting gutta-percha. The forester in charge of the district has been ordered to give these people the necessary instructions.

In accordance with the provisions of the forest act, the undersigned would approve an application for a twenty-year exclusive privilege to gather all forest products in the Rio Grande Valley south of the town of Cotabatò, provided the applicant makes a satisfactory showing that the privilege granted would be used, and that each of the forest products asked for would be gathered in quantities according to the area of the country granted.

The Rio Grande Valley is one of the most fertile regions in the world. The soil is very rich, easily drained, and easily cultivated. The foothills on each side of the valley afford a variety of elevation above sea level suitable to the planting of rubber and gutta-percha. The rainfall averages about 2,000 millimeters per year. The conditions of soil and climate and elevation seem to warrant the planting of rubber and gutta-percha on a large scale.

The applicant for a twenty-year exclusive privilege would be required to state that, in addition to fulfilling the ordinary requirements of the forest act, regulations and orders, he would make an effort to stop the felling of gutta-percha trees in his district, and that he would plant at least 250 acres of rubber and gutta-percha trees per year, until he had planted the full area of public land that an incorporated company would be allowed to purchase from the government. At present, this limit is fixed at 2,500 acres. The provision of purchase of public land has not been extended to the Rio Grande Valley at the present, but will be in the near future.

The company will not be required to plant any special variety of rubber, but will be expected to plant at least 50 acres in gutta-percha each year. The land so planted would be land that the company has purchased or desires to purchase from the Philippine government.

Every assistance will be afforded applicants in looking over the region desired. A trained forester will be placed at the disposal of the applicant for this purpose, and all data in this office concerning the region and its resources will also be made available.

The Philippine Islands comprise an area of more than 73,000,000 acres, of which less than 6,000,000 acres are under cultivation. At least 50,000,000 acres are woodlands, of which much less than 1 per cent is held by private owners.

There are large areas of public forest in the islands of Mindanao, Mindoro, Palawan, and Samar that are practically untouched and where deep, rich soil would amply repay any effort at cultivation.

The undersigned, in a recent trip across the island of Mindanao, was much impressed with the depth and richness of the soil in that region, where cut banks, more than 10 feet in depth, showed nothing but the rich, black decomposed lava, which is so wonderfully fertile. As a recent traveler recently remarked, the Philippine Islands are the richest, most fertile undeveloped regions in the Orient. These lands are awaiting cultivation, and this office will assist in any way any person or company desiring to begin operations.

Applications for licenses for the new fiscal year will be received during April, May, and June, and as all licenses are dated to begin July 1, I would suggest that your friends make an effort to take up this matter before the end of May.

Very respectfully,

GEORGE P. AHERN, *Director of Forestry.*

Copy respectfully furnished the honorable the secretary of the interior, for his approval.

Approved:

DEAN C. WORCESTER,
Secretary of the Interior.

A FEW PERTINENT EXTRACTS FROM THE ABOVE NOTES.

CASTILLOA.

A continuously humid climate is not necessary to the growth and the productiveness of *Castilla.*

The percentage of rubber increases during the dry season and diminishes during the wet.

The gathering of rubber from trees less than 8 years old is not likely to be advantageous.

The rubber of *Castilla* is scarcely inferior to that of *Hevea;* the supposed inferiority is due to substances which can be removed from the milk by heat and by dilution in water.

Estimates from various American planters in Mexico: Yield, 6-year-old tree, 4 to 6 ounces; 7-year-old tree (bled to death), 1 pound; 8 to 10 year old tree, 1 pound.

It is believed that the size of the rubber tree has more to do with the amount of rubber it will produce than its age. Two and three-tenths pounds rubber milk produce 1 pound of rubber.

Average yield.

Age.	Amount.	Number of trees.
	Ounces.	
7 years	9.3	257
8 years	14.25	14
9 years	18	7
10	17.5	4
12 years	28.9	12

Acre at 12 years yields 314 pounds.

Three varieties of Castilloa: *Alba, negra, rubra.*

Alba is hardiest and best.

Requires very deep soil, of a rich, loamy character, with best of drainage.

Grows best at an elevation of 1,000 to 1,500 feet; at sea level refuses to grow well after reaching a height of 10 to 15 feet. The root is very deep. Robust tree; stands wind; likes drought. A rapid grower; in Ceylon has reached a height of 34 feet in four years, with a girth of 25 to 30 inches.

Seed hardy and easily packed; keeps well in charcoal.

Castilloa susceptible to weeds.

PARA.

A Para-rubber tree in the Botanical Garden at Penang, planted on poor, gravelly soil on a dry bank, was first tapped at the age of 11 years. The total yield from six tappings within the next five years yielded 16 pounds and 10 ounces of rubber.

Small amount of cultural skill required to successfully plant and cultivate Para rubber.

The tree has adapted itself to various climatic influences, and on the Gold Coast of West Africa found in Botanical Garden, Aburi, 1,500 feet above sea level; temperature, 81.5° F.; rainfall, 47 inches.

Para rubber will yield in paying quantities on different soils on hillsides to 2,700 feet elevation.

Does well at 500 feet elevation; better between 1,000 and 1,500 feet above sea level. Should be planted in fairly good soil; it will not do well in a fairly stiff soil. Temperature best suited for its cultivation, 74° to 94° F.; rainfall, 80 to 150 inches.

Distance apart to plant, 15 by 15 feet, 200 trees per acre. Holes, 2 by 1½ feet, and should be filled with top soil.

Seed should be packed in damp, powdered charcoal; may be kept a month, and 75 per cent germinate. Seed should be washed in a solution of sulphite of copper just before packing. Seed above ground in ten days; twenty days, 10 inches high. Five thousand seed packed weigh 50 pounds. Seeds begin to ripen about the last of July.

Nursery, good piece of land, broken to 15 inches, well cleared and worked. Beds 20 by 4 feet, drain between 1 foot deep and wide. Cover seed with one-half inch of soil. Lay seed on its side. Seed planted 6 by 6 inches will grow 6 feet in 10 months. Nursery should be protected from insects and rats. Plants should be protected from the sun until 2 feet above bed; should be watered twice daily. Cover should be gradually removed and at the end of two months will be found to grow better in the open.

Taproot should be put in straight and not curled up. Plants require care until 6 feet high.

Tapping.—Latex does not flow freely through the middle of the day. It is usual to tap from 4 to 7 a. m. and from 3.30 p. m. to dark. Trees are tapped when they show a girth of 2 feet without regard to their age. Not found profitable to tap higher than a coolie can reach standing on the ground.

The outer bark is scraped off to stimulate and increase flow. The bark is shaved off about two weeks before tapping it again. On some estates the whole trunk up to 6 feet is shaved; on others just where tapped.

The sharper the implement the better the flow and the less the loss by coagulation and cuts.

The best season for tapping is between June and November. The latex seems to exude most freely in wet weather.

Hevea dislikes wind and flourishes in sheltered positions; seems to grow best in roughest, rockiest positions.

Para trees develop poorly in the swampy districts of Ceylon, but prosper excellently in higher, drier locations.

Three grades of Para—fine, medium, coarse. Governed by amount of transparency and care in preparation for the market.

During the season 1896–97 the planting of Para rubber was taken up seriously in the Federated Malay States. The first tapping in this region began in 1904.

Total acreage planted in Para rubber in the Far East in 1904, 70,000 acres. Will be in full bearing in 1911, and may yield 14,000,000 pounds, hardly more than 10 per cent of present world's consumption.

The accompanying map is taken from Dr. Penoyer L. Sherman's Bulletin on "The Gutta-Percha and Rubber of the Philippine Islands."

The samples of rubber and gutta-percha gathered personally by Doctor Sherman, and the samples of rubber gathered by him and by Governor Offley, of Mindoro, and others, show that there is a wide distribution of high-grade native rubber in the Philippine Islands. The gutta-percha gathered by Doctor Sherman was found to be of high grade.

The Para, *Castilloa*, Ceará, and Assam rubber trees have grown well in a number of places in these islands. The oldest of the three first-mentioned varieties is not over 4 years of age and not ready for tapping, but all show good growth.

There are extensive regions of unoccupied public land, from sea level to 6,000 feet elevation, awaiting the settler or company, where rich, well-drained soil, ample rainfall, and other conditions combine to make the prospect attractive to rubber planters.

HOW PUBLIC LAND MAY BE ACQUIRED.

The public-land laws allow homesteads to citizens of the islands and of the United States; the amount of land that may be taken up under the homestead act is 16 hectares (2.47 acres per hectare).

Individuals may purchase 16 hectares of land. Individuals or companies may lease 1,024 hectares of public land for twenty-five years, with privilege of renewal for the same period. Cost of lease is 50 centavos to ₱1.50 per hectare per year.

Incorporated companies may purchase 1,024 hectares of public land at a minimum charge of ₱10 per hectare. One-quarter of the purchase price is paid at time of purchase; the balance may be paid at any time within five years.

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Ferguson, J. (compiler). All about Rubber and Gutta-percha, 3d ed., 1899. Publishers, John Little & Co., Singapore. Price and postage, rupees 5.

Johnson, W. H., director agriculture, Gold Coast, West Africa. The Cultivation and Preparation of Para Rubber, 1904. Publishers, India Rubber Journal, 37 and 38 Shoe Lane, London, England. Price and postage, 8s.

Pearson, Henry C. Crude Rubber and Compounding Ingredients, 1899. Publishers, India Rubber Publishing Company' 150 Nassau street, New York, N. Y. Price and postage, $5, United States currency.

PERIODICALS.

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The India Rubber World, 150 Nassau street, New York, N. Y. Annual subscription, $3, United States currency. Single copies, 35 cents, United States currency.

India Rubber Journal, London, England. Annual subscription, 16s. Single copies, 6d.

The Tropical Agriculturist, A. M. and J. Ferguson, Colombo and Ceylon. Annual subscription, $5, United States currency.

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The Gutta-percha and Rubber of the Philippine Islands. By Penoyer L. Sherman, jr., Ph. D. (Published by Bureau of Science, Manila, P. I.)

Para Rubber. By Herbert Wright, Colombo, 1905.

L'Hevea brasiliensis. By G. Vernet, Hanoi, China,

BULLETINS

ON

CHARCOAL INDUSTRY, LUMBER AND SAWMILLS

IN THE

PHILIPPINE ISLANDS.

BUREAU OF FORESTRY.

(Bulletin No. 2.)

THE CHARCOAL INDUSTRY IN THE PHILIPPINE ISLANDS—NATIVE METHODS, JAPANESE METHODS, AND COMPARISON—WASTE IN MAKING—PRICES—SPECIES USED.[a]

By WILLIAM M. MAULE.

LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
BUREAU OF FORESTRY,
Manila, March 23, 1906.

SIR: I have the honor to inclose herewith an article by Forester William M. Maule on "The Charcoal Industry in the Philippine Islands," together with a Spanish translation of same, and respectfully recommend that it be published as Bulletin No. 2.

Very respectfully,

GEORGE P. AHERN, *Director of Forestry.*

The SECRETARY OF THE INTÉRIOR, *Manila, P. I.*

The charcoal industry in the Philippine Islands, while not one of the most important of commercial enterprises, is yet kept alive by certain market demands which can not be filled from other sources.

The call for charcoal in Manila, which is the leading market, is somewhat limited, but steady. Larger consumers are usually supplied by contract, while smaller users buy from the open market. Aside from the considerable amount used in the provinces for laundry purposes and for smelting ores, which, in the aggregate, probably falls but little below that used in Manila, the more varied uses in the latter place are for laundries, tailor shops, hatters, restaurants, bakeries, and metal workers.

The following table shows the amount of charcoal shipped to Manila by provinces during the fiscal year 1904–5:

Province.	From public lands.	From private lands.	Province.	From public lands.	From private lands.
	Cu. met.	*Cu. met.*		*Cu. met.*	*Cu. met.*
Zambales	2,591		Tarlac	8	
Pampanga	608	1,170	Bulacan	2	
Bataan	544		Tayabas	1	
Pangasinan	182				
Mindoro	29			3,984	1,182
Laguna	19				
Batangas		12	Sum total	5,166	

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[a] The following illustrations accompany this report and are on file in the War Department:

Types of Philippine kilns:

FIG. 1. Native kiln (general use).

FIG. 2. Type of kiln, Masinloc, Zambales, P. I.

FIG. 3. Kilns in various stages: (1) Burning; (2) complete before burning; (3) nearing completion (not capped).

FIG. 4. Oven complete (clay dome and two vents).

FIG. 5. Medial transverse section of oven. Door on left and chimney on right. Flame starts upward from door, along top, and down to chimney.

FIG. 6. Floor plan of kiln. By being pear shaped it has better draft than if circular.

NATIVE METHODS OF MAKING CHARCOAL.

The native methods of charcoal burning as pursued in Zambales and Pangasinan provinces may be taken as typical:

The wood which is to be used, having been cut into 1-meter lengths, is piled on end about a central guide post or pole having the required height of the kiln, or about four wood lengths. Each tier decreases in diameter, and they finally converge to form a cone-shaped pile. (Figs. 1 and 3.)

There are no uniform dimensions in the kilns, but an average one will have a basal diameter of 2 meters by 3 in height.

In order to provide draft in burning, a small radial vent leads along the ground to the central axis, then upward to the apex of the cone. At the time of building, the lower portion of this chimney is filled with combustible materials—leaves or small dry branches.

At Masinloc certain burners employ another method of piling, whereby the wood is arranged in a horizontal radiating manner of from 2 to 3 concentric circles. Kilns of this type are but slightly conical and are rarely more than 1 meter high. The same system of draft is given as that of the former mehod. In either case, in order to complete the kiln, the surface is capped by a layer of clay or loam and during burning is constantly moistened.

In starting the burning, a fire is placed at the lower vent and, in order to distribute it properly, small openings are made on the surface of the cone. During the course of burning the fire works from below toward the openings above, and as carbonization of parts is complete, new drafts are made and old ones closed. Sufficient information is not at hand to show the comparative merits of the above methods, but as the former is more frequently used, it is no doubt preferable. One week is usually required to burn a kiln whose construction and burning require the services of three men for one week.

WASTE.

From a kiln whose volume is 12 cubic meters (which is an average size) the yield in charcoal never exceeds 9 cubic meters, the waste being divided between 1 cubic meter of partially carbonized wood and 2 cubic meters of ash. On an average but 7 cubic meters of charcoal are secured, and at times only 5.

The improperly carbonized wood is usually replaced in the following burning, thereby diminishing the waste.

Rarely is the oven protected by a roof, and in case of heavy rain the cap is washed off and the fire quenched.

From the upper Zambales coast charcoal is usually shipped by means of paraos, the owners of which buy either direct from the burners or secure a license and employ men under their supervision.

In the provinces, charcoal is usually bought and sold by the "batulán" (Tag.), which is 1 cubic yard (Spanish) or 0.584 m/3. In general, the price paid per batulán in the provinces is from 2 to 3 pesetas (40 to 60 centavos, Philippine currency).

The foregoing methods are used in producing charcoal on a commercial scale. By a third method, which is applied only to making small quantities for household use, the wood is embedded in rice hulls or chaff and the mass fired. This method requires about two days to burn, after which the fire is extinguished by water—a method observed to be in general use in Pampanga.

JAPANESE METHOD.

STRUCTURE OF KILNS.

In the vicinity of Subic, Zambales, and Moron, Bataan, several Japanese licensees have begun the manufacture of charcoal according to methods employed in Japan, and as such methods seem superior in many ways to those in general use, their introduction should meet with favor. Permanent kilns are constructed on a well-drained hillside, half the kilns being excavated from the bank, while the front, containing a door for filling, is built up from stone and clay.

Having constructed the kiln, which, on an average, is slightly more than 1 meter deep and having a capacity of about 5 cubic meters, a chimney, with diameter of 3 inches, is placed at the rear, having its inner opening at the bottom of the kiln. By filling the unfinished kiln with wood and rounding off the top a model is formed for the dome, which consists of a 6-inch layer of clay. In burning this first kiln, the clay is baked and, if of good quality and protected by roof, will last several years. Three small holes are made in the dome, which furnish draft.

In order to insure complete and even burning, the ground plan of the kiln is made pear shaped, with the neck portion near the door. Such shape insures a better draft than where the plan is round.

FILLING THE KILN.

In securing wood for burning, but little care is taken in selecting species, there being but few that are not suitable. Pieces are cut into lengths of height of kiln and range from very small to 10 inches in diameter, above which size they are split. The larger pieces are placed toward the center of the oven, and all are builded in as compactly as possible by a man within. Having thus filled the kiln to the door, a small pile of dry wood is placed in front, from which the interior is fired.

BURNING.

After burning some four hours, with all drafts open, or until about 4 inches of red coals appear over the top of the corded wood within, the door is closed or builded shut, with the exception of a small vent below, by means of cross logs cemented with clay.

The fire, beginning at the top, works downward, as shown in Fig. 5. In from three to four hours more, the fire being well distributed, the three small vents of the dome are closed by clay, leaving open only the small aperture at the bottom of the door and the chimney, by which further burning is regulated. The kiln requires frequent attention to see that the fire is not too strong or too weak.

Three days are required to carbonize the wood, after which all vents are closed, in order to smother out the fire, which requires an additional three days, so that, on an average, one week is required to produce one kiln of charcoal. On an average, three kilns are kept burning constantly, and require a crew of from 6 to 8 men and 1 foreman.

PRODUCT.

The charcoal comes from the kiln in excellent condition; rarely is there found any waste caused by under or over burning, and so perfect is the carbonization that the bark is not consumed. A kiln whose volume is 5 cubic meters will average 24 sacks of charcoal.

VOLUME OF KILN.

Five cubic meters contain 5.4 cubic meters of loosely piled wood and yield 4.30 cubic meters of charcoal, the approximate loss being 1 cubic meter. The foreman stated that a safe average of loss in burning would be two-fifths.

In summing up the advantages of Japanese methods over those employed by the natives, we find the following:

Kilns can be used repeatedly, with but little repair.

The burning is more easily regulated and results in less waste.

The product is not damaged by water, which is frequently used by natives in quenching the fire.

The charcoal comes out clearer than where the oven must be destroyed in removing it, and brings better prices.

In places where Japanese have been operating the natives have adopted their methods, working at first under a Japanese foreman, or employing him, and, seeing the advantage gained, they will no doubt adopt it generally.

Profits, Japanese method.

Charcoal gang, one month:	
8 laborers, at ₱0.60 per diem	₱144.00
1 foreman, at ₱2 per diem	60.00
Freight on 350 sacks of charcoal to Manila (average monthly production), at ₱0.30 per sack, by steamer	105.00
Loading on steamer, at ₱0.05 per sack	17.50
Discharging steamer, at ₱0.05 per sack	17.50
Government charge, at 10 per cent market price (at kiln)	28.00
Combined expenses of making and shipping	372.00
Contract price in Manila, at ₱3 per sack	1,050.00
Profit of one month	678.00

No account has been made of initial cost of sacks, which average ₱0.15 each, and are used a number of times.

Heretofore the source of timber used in charcoal making has been taken from the mangrove swamps. In many places near Manila the best of these mangrove species are becoming rare or are of too small size to use in burning. In such cases species of the semiopen forests, or "parang," are selected, and in certain parts of Pampanga charcoal is made from cauayan (Bambusa), which has been planted for fuel purposes.

The following list includes species largely cut for charcoal:

MANGROVE.

Bacauan (*Brugiera*).
Tangal (*Rhizophora*).
Pagatpat (*Sonneratia pagatpat*).
Culasi (*Lumnitzera*).
Tibigi (*Xylocarpus*).
Dungon-late (*Heritiera littoralis*).

SEMIOPEN, OR "PARANG."

Agoho (*Casuarina equisetifolia*).
Binayuyo.
Guayabas (*Psidium guayava*) introduced sp.
Madrecacao (*Gliricidia masculata*) introduced sp.

MANAGEMENT OF FORESTS FOR CHARCOAL BURNERS.

The manufacture of charcoal from trees cut indiscriminately from the high forest is usually undesirable from a sylvicultural point of view, as clear cutting is generally practiced. In places where mangrove species have been exhausted, or where such do not exist, and where it is necessary that forest species be used, a simple plan of management can be devised whereby an "improvement cutting" can be made.

The forests in provinces adjacent to Manila are composed largely of third-group species, many of which are important from a timber standpoint, and can be lumbered profitably, owing to cheap rates of transportation. It is obvious that the reproduction of such species should be favored, with the view of timber producers.

Growing in association with these species are numerous second-story or even taller trees, which are generally of a hard character, but never attain merchantable size. Such trees will not only be valuable for charcoal purposes, but their removal from the forest will promote the growth of younger stages of the merchantable species.

In carrying out such plans, a list of prohibited species should be furnished the licensee as pertinent to his cutting locality. Owing to the frequence of the above-mentioned species, it is believed that the adoption of this plan will not cause undue hardship to operators.

In order to show the importance of a safe and continuous supply of fuel, it may be of interest to state that the demand for fuel in certain of the Federated Malay States has assumed such proportions that a plan of management has been adopted for mangrove swamps.

BUREAU OF FORESTRY.

[Bulletin No. 4.]

I. MECHANICAL TESTS, PROPERTIES, AND USES OF THIRTY PHILIPPINE WOODS—II. PHILIPPINE SAWMILLS, LUMBER MARKET, AND PRICES.

By ROLLAND GARDNER, *Manager of the timber-testing laboratory.*

LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
BUREAU OF FORESTRY, OFFICE OF THE DIRECTOR,
Manila, September 7, 1906.

SIR: I have the honor to transmit herewith a manuscript entitled "I. Mechanical Tests, Properties, and Uses of Thirty Philippine Woods; II. Philippine Sawmills, Lumber Market, and Prices," by Rolland Gardner, manager of the timber-testing laboratory, bureau of forestry, and to recommend its publication as Bulletin No. 4 of the bureau of forestry.

Very respectfully,

GEORGE P. AHERN,
Director of Forestry.

The SECRETARY OF THE INTERIOR, *Manila, P. I.*

INTRODUCTION.[a]

(By H. N. WHITFORD, forester, chief of division of forest products.)

This bulletin has been prepared in response to numerous inquiries concerning Philippine woods and milling operations in the Philippines. The results of the timber tests published represent the present knowledge of the subject and are not to be considered final, for such results can be obtained only from a large number of tests of properly identified botanical material from many localities and habitats. With two exceptions the woods tested have been representative of the commercial material found on the market, and are fair samples of those used by contractors and others. Indeed, in many instances they represent more approximately an average of the actual material used in construction than woods collected with botanical specimens might do. Nevertheless, the value of mechanical tests on properly determined material obtained from districts where logged is not underestimated, and such tests will be made as rapidly as possible.

Since the microscopic characteristics of Philippine woods have not been studied it is not always possible to check market material with properly identified museum specimens. It is probable that structural differences can not be detected between closely related species, so that with good microscopic sections it will not always be possible to identify closely related woods. In such cases botanical specimens alone will be the final test.

It seems almost superfluous to caution against the blind acceptance of the names of trees and woods given by native woodsmen. This error becomes even more grievous when, without any botanical knowledge or specimens, scientific names are attached as equivalents. It is true that many of the natives are keen in distinguishing trees, and can often point out with great skill the differences. While their help is essential to one who would have first-hand knowledge of timber trees in the forest, yet such information should be constantly verified with botanical material and wood specimens. By such methods the bureau is adding to its list of properly determined wood specimens.

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[a] The illustrations mentioned have been omitted from this report and are on file in the War Department.

PART I.

MECHANICAL TESTS, PROPERTIES, AND USES OF THIRTY PHILIPPINE WOODS.

POPULAR DISCUSSION OF THE QUALITIES OF WOODS AND MEANING OF TIMBER TESTS.

Every wood worker knows more or less of the properties of the various kinds of woods which come under his observation, but this knowledge is usually gained by long experience. He may know that certain woods are strong or stiff, but he seldom learns from his own experience how strong or stiff they are. For this reason the design of structures is often largely a matter of guesswork, the designer or builder not having experimental data regarding the strength, stiffness, and other properties of timber. In the timber-testing laboratory these various properties and characteristics are studied, and the results are collected in such form that others may use them to determine the fitness of woods for certain purposes.

Timber, as a material of construction, is required to resist various stresses. A short, thick column must resist simple compression along the grain. A railroad tie must resist compression across the grain where the rail rests upon it, and also shearing across the grain by the edges of the rail. Simple tension and shearing along the grain are not common in practice, although these stresses frequently occur in combination with other stresses, as in cross bending. It is possible to subject timber to any one of the above-mentioned stresses, but it is much more common in practice that timber must withstand a number of these stresses at the same time.

Timber also possesses such properties as stiffness, hardness, toughness, flexibility, etc., which are all important in determining the fitness of any wood for certain purposes. Strength and stiffness are measured in pounds per square inch, but no satisfactory units have yet been proposed by which such properties as hardness and toughness may be measured.

The beam is one of the most common members in general construction and the stresses involved are most complex. Suppose we have a beam 4 by 4 inches in section, 5 feet long, and supported at each end. At the middle of this beam a load of 500 pounds is applied and the beam bends one-sixteenth of an inch at the middle; another 500 pounds bends it one-sixteenth of an inch more, and so on until a point is reached where an added 500 pounds produces an additional deflection of more than one-sixteenth of an inch. Here the true elastic limit is reached, or, to state this a little more accurately, the true elastic limit is reached when deflection is no longer proportional to load. This is approximately the point where the material begins to be injured, and if a beam is loaded beyond this point it will not return to its original condition when the load is removed. Even small loads produce some permanent set or bend in beams, but the true elastic limit is important as showing approximately the point where injury begins. Thus the true elastic limit is located. Now what do the figures mean which are tabulated under "Fiber stress at the true elastic limit, pounds per square inch?" Evidently not the load on the beam when the true elastic limit was reached, for that would be applicable only to a beam of the same size, under exactly the same conditions as the one tested. To answer this question, it is necessary to examine the stresses produced.

As the beam is bent, its curve is approximately the arc of a circle. The bottom of the beam becomes longer and the top shorter, therefore the bottom is in tension and the top in compression. Upon the supposition that these stresses are equal, the stress at the extreme top and bottom of the beam is computed and is tabulated under "Fiber stress at true elastic limit, pounds per square inch."

Fiber stress at apparent elastic limit and modulus of rupture, as tabulated, are also approximate stresses at the extreme top and bottom of the beam. The apparent elastic limit is a point a little higher than the true elastic limit. It is located arbitrarily, as explained under "Methods of testing and results of tests," and has no particular significance, although it was used extensively in early timber tests. The true elastic limit may be considered as a limit of safety and the modulus of rupture as the greatest stress which the wood will stand in cross bending. In practice, the fiber stress is always kept much lower than the fiber stress at the true elastic limit.

No attempt is made to measure brittleness and toughness, but in cross-bending tests a brittle wood may be distinguished from a tough wood by the relation existing between the true elastic limit and rupture, for in brittle woods the amount of bending is small between the true elastic limit and rupture, while in tough woods it is great. Most Philippine woods are brittle, Dungon and Malugay being the only ones which have been investigated and found to possess the property of toughness to any considerable degree. These two, however, are quite tough, and compare favorably with white oak for bending by steaming. Woods like Molave, Calantas, Ash, and Pine are brittle, while those like Malugay, Dungon, Elm, Hickory, and Oak are tough.

The modulus of elasticity is the measure of the stiffness of a material. If a beam of one kind of wood has a modulus of elasticity of 1,000,000 pounds per square inch and a second beam of another kind has a modulus of elasticity of 2,000,000 pounds per square inch the second wood is twice as stiff as the first, and if the two beams are of exactly the same dimensions the first beam will bend twice as far as the second under a given load. For example, Yacal and Guijo are among the stiffest Philippine woods, being approximately twice as stiff as woods like Banuyo and Calantas. (See Table I.)

Now consider two similar beams of the same material, supported at each end and loaded in the middle. If beam No. 1 is made twice as long as beam No. 2, other dimensions being the same, it will bend eight times as far under a given load but will be only half as strong. If beam No. 1 is made twice as high as beam No. 2, other dimensions remaining the same, it will bend only one-eighth as far under a given load but will be four times as strong. If beam No. 1 is made twice as wide as beam No. 2, other dimensions remaining the same, it will bend only one half as far but will be twice as strong. If the beams are of the same dimensions throughout and the load on beam No. 1 is double that on beam No. 2, beam No. 1 will bend twice as far.

A strong wood is not necessarily stiff, nor is a stiff wood necessarily strong, although in many cases these properties appear to be closely related. By referring to Table 1, it is seen that the Betis, from Tayabas, which was tested, was about 60 per cent stronger in cross bending than that from Ambos Camarines, although it was not quite as stiff. With few exceptions, timber is much stronger when dry than when green. The weight of moisture in timber just from the saw is often from 80 to 90 per cent of the weight of the wood itself. This amount of moisture may be reduced to 30 to 35 per cent of the weight of dry wood, without showing any increase in strength, but when the wood is dried beyond this point the strength usually increases quite rapidly, well-seasoned timber frequently being from 50 to 70 per cent stronger than green timber. The amount of increase in strength is shown for the various woods in Tables I and II.

As wood dries, the fibers become harder, stiffer, and stronger, but the wood also shrinks, which causes checks that tend to weaken the timber. In most woods this latter effect is much less than the former and the wood shows a decided increase in strength and stiffness, but in hard, brittle woods the checking effect is quite serious; for example, the Ipil and Molave which were tested showed a decrease in modulus of rupture when seasoned, as is shown by Table I. The tendency to check while seasoning may be overcome to a large extent by drying slowly and evenly, but in large timbers the outer surface dries months or even years before the interior, so that it is practically impossible to prevent checking. This is one reason why the strength values for large timbers are somewhat smaller than for small timbers.

Timber is thoroughly seasoned when it contains 10 to 12 per cent moisture throughout, and will arrive at that percentage of moisture in time if exposed to air but protected from rain and sun. If it is made drier than this by artificial means, it will reabsorb moisture from the atmosphere until it arrives at 10 to 12 per cent moisture. There is considerable variation in the moisture content of timber seasoned by artificial means. Usually timber whose moisture content is less than 20 per cent will pass for seasoned timber.

In tropical countries the most desirable quality sought in wood is durability. This is true because the destructive elements to timber are greater than in temperate regions. Because of continuous heat and moisture, fungus growth is undoubtedly more rapid in the tropics. The universal presence of the white ant is perhaps the most destructive element that makes the use of durable timber almost imperative for railroad ties and for general construction purposes. Such timbers as are used for ties in cold regions would not last nearly as long here as there, but some of the best native woods are extremely durable. In temperate zones ten years is considered a long life for an untreated tie, but in these islands the extremely durable woods, like Ipil and Molave, are known to have been in the ground for more than ten years without any sign of decay. The ravages of the sea worm (teredo) restrict the use of untreated timber, in contact with salt water, to those species that are especially adapted to resisting the attacks of this enemy. The softer Philippine woods, like Lauan, and imported woods, like Oregon Pine, are quickly destroyed when placed in salt water, while Aranga and Betis are highly valued because of their great durability under these conditions.

MATERIAL USED FOR TESTING—DESCRIPTION OF BEAMS.

MATERIAL USED FOR TESTING.

It being impracticable at the time these tests were started to secure timber which had been botanically determined, this series of tests was made almost entirely upon timber purchased in the market. The Sacat and Balacat, which were obtained at the Lamao Forest Reserve, were the only woods which were not secured in the market. In buying care was exercised to select timber which well represented the quality generally used in construction. Most of the timber tested was clear and sound.

No standard rules for the inspection of timber are in use in Manila by which the quality and condition of the timber tested may be described. Where defective beams have been tested, the beams will be described whose moduli of rupture correspond to the average, maximum and minimum moduli of rupture as tabulated. All blocks used for compression and shear tests were clear and sound.

DESCRIPTION OF BEAMS.

The following is a list of the woods used where all the beams tested were clear and sound:

Name.	Locality.	Name.	Locality.
Lauan	Mindanao.	Ipil	Palawan.
Do	Zambales.	Dungon	Masbate.
Apitong	Mindanao.	Do	Mindanao.
Guijo	Ambos Camarines.	Supa	Locality unknown.
Do	Mindoro.	Betis	Tayabas.
Yacal	Ambos Camarines.	Do	Ambos Camarines.
Narra	Near Laguna de Bay.	Aranga	Do.
Do	Cagayan.	Balacbacan	Negros Occidental.
Tanguile	Locality unknown.	Mayapis	Laguna.
Sacat	Lamao Forest Reserve.	Malugay	Mindoro.

The following is a description of the beams used in testing that were more or less defective:

APITONG FROM ZAMBALES.

[Six beams contained slight defects.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.
Average	Clear and sound	Clear and sound.
Maximum	do	Do.
Minimum	One knot and check	Do.

MOLAVE FROM LAGUNA DE BAY.

Many beams contained knots and checks which are characteristic of Molave. There were no defects in the middle of beams which would seriously affect strength.

MOLAVE FROM AMBOS CAMARINES.

Many beams contained knots and checks which are characteristic of Molave. There were no defects in the middle of beams which would seriously affect strength.

TANGUILE FROM ZAMBALES.

Two beams contained slight defects. All beams whose moduli of rupture correspond to those tabulated were clear and sound.

SACAT FROM TARLAC.

[Four beams contained slight defects.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.	Moisture under 20 per cent.
Average	Clear and sound	Clear and sound	Clear and sound.
Maximum	do	do	Do.
Minimum	do	Heart check full length	Do.

IPIL FROM AMBOS CAMARINES.

All beams clear and sound but slightly cross-grained.

IPIL FROM MINDORO.

[Eight beams contained slight defects.

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.
Average	Clear and sound	Clear and sound.
Maximum	do	Do.
Minimum	One knot in middle	Do.

DUNGON FROM AMBOS CAMARINES.

[Four beams slightly defective.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.	Moisture under 20 per cent.
Average	Clear and sound	Clear and sound	Clear and sound
Maximum	do	do	Do.
Minimum	One knot and check	do	Do.

MALASANTOL (LOCALITY UNKNOWN).

[Two beams slightly defective.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.	Moisture under 20 per cent.
Average	Clear and sound	Clear and sound	Clear and sound.
Maximum	do	do	Do.
Minimum	do	do	One-third sap wood.

SUPA FROM TAYABAS.

[Five beams slightly defective.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.
Average	Clear and sound	Clear and sound.
Maximum	do	Do.
Minimum	do	Large check in middle.

BALACAT FROM LAMAO FOREST RESERVE.

Small knots were quite common. There were three or four ¾-inch knots in each beam.

BALACAT FROM TARLAC.

[Ten beams slightly defective.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.	Moisture under 20 per cent.
Average	Clear and sound	Clear and sound	Clear and sound.
Maximum	do	do	Do.
Minimum	do	One ½-inch knot	Do.

MACAASIN (LOCALITY UNKNOWN).

[Two beams slightly defective.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.	Moisture under 20 per cent.
Average	Clear and sound	Clear and sound	Clear and sound.
Maximum	do	do	Do.
Minimum	Checked on side	do	Do.

CALANTAS FROM ALBAY.

Two beams were slightly defective. All beams whose moduli of rupture correspond to those tabulated were clear and sound.

CALANTAS FROM MINDORO.

[Five beams were slightly defective.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.
Average	Clear and sound	Clear and sound.
Maximum	do	Do.
Minimum	One ½-inch knot in middle	One small knot and bad check.

TINDALO (LOCALITY UNKNOWN).

[One beam defective.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.
Average	Clear and sound	Clear and sound.
Maximum	do	Do.
Minimum	Slight check on top	Do.

TINDALO FROM AMBOS CAMARINES.

[Five beams defective.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.	Moisture under 20 per cent.
Average	Clear and sound	Clear and sound	Clear and sound.
Maximum	do	do	Do.
Minimum	Bad check in middle	Slight check and one knot	Do.

TINDALO FROM MASBATE.

Two beams were defective. All beams whose moduli of rupture correspond to those tabulated were clear and sound.

AMUGUIS FROM MINDORO.

Eight beams were defective. All beams whose moduli of rupture correspond to those tabulated were clear and sound.

ACLE FROM TARLAC.

[Two beams were defective.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.	Moisture under 20 per cent.
Average	Clear and sound	Clear and sound	Knotty in middle.
Maximum	do	do	Do.
Minimum	do	do	Do.

ACLE FROM ZAMBALES.

[Four beams were defective.]

	Moisture over 35 per cent.
Average	Slightly checked.
Maximum	Clear and sound.
Minimum	One knot.

BANSALAGUIN (LOCALITY UNKNOWN.)

One beam was defective. All beams whose moduli of rupture correspond to those tabulated were clear and sound.

PALO MARIA FROM ZAMBALES.

[Three beams were defective.]

	Moisture over 35 per cent.
Average	Clear and sound.
Maximum	Do.
Minimum	Heart check on side.

BATITINAN (LOCALITY UNKNOWN.)

[Thirteen beams were defective.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.
Average	One small knot	Three 1-inch knots.
Maximum	Clear and sound	Two 1¼-inch knots.
Minimum	Two small knots	Three 1-inch knots.

BANUYO FROM MASBATE.

[Five beams were defective.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.
Average	Clear and sound	Clear and sound.
Maximum	One 3-inch knot near end	Do.
Minimum	Clear and sound	Do.

SASALIT FROM ZAMBALES.

[Twenty-one beams were defective.]

	Moisture over 35 per cent.	Moisture 20 to 35 per cent.
Average	Small checks on two sides	Clear and sound.
Maximum	Clear and sound	Small checks on two sides.
Minimum	do	Checks on three sides.

LIUSIN FROM BATAAN.

[Four beams were defective.]

	Moisture over 35 per cent.
Average	Clear and sound.
Maximum	Do.
Minimum	Cross-grained.

LUMBAYAO FROM BASILAN ISLAND, MORO PROVINCE.

One beam was defective. All beams whose moduli of rupture correspond to those tabulated were clear and sound.

METHODS OF TESTING AND RESULTS OF TESTS.

The machine used in making the following tests is a Tinius Olsen testing machine with a capacity of 200,000 pounds.

CROSS-BENDING TESTS.

All beams used for cross-bending tests (Table I) were either 3½ by 3½ inches or 4 by 4 inches in section, with a span of 60 inches. The machine was operated at a speed of 0.3 inch per minute and the deflection was noted at various loads during the tests. The curve was then plotted between deflection in inches and load in pounds, and upon this curve were located the true elastic limit, the apparent elastic limit, and the point at which failure occurred.

The fiber stress at the true elastic limit was calculated by the standard formula:

$$\text{Fiber stress at true elastic limit} = \frac{3\,W\,L}{2\,B\,H^2} \text{ where,}$$

W equals load in pounds at true elastic limit,
L equals span in inches,
B equals breadth of beam in inches,
H equals height of beam in inches.

The term "apparent elastic limit," as used in this bulletin, is defined by Johnson[a] as follows:

"The apparent elastic limit is the point on the stress diagram of any material in any kind of a test at which the rate of deformation is 50 per cent greater than it is at the origin."

The fiber stress at the apparent elastic limit and the modulus of rupture were determined by the same formula which was used to determine the fiber stress at the true elastic limit, viz:

$$\text{Fiber stress at the apparent elastic limit} = \frac{3\,W'\,L}{2\,B\,H^2} \text{ where,}$$

W′ equals load in pounds at the apparent elastic limit; and

$$\text{Modulus of rupture} = \frac{3\,W''\,L}{2\,B\,H^2} \text{ where,}$$

W″ equals load in pounds at rupture.

Plate I shows the true elastic limit and the apparent elastic limit as located upon a typical stress diagram.

After the stress diagram was drawn, a tangent was drawn to the curve at the origin and the modulus of elasticity was determined by the following well-known formula:

$$\text{Modulus of elasticity} = \frac{W\,L^3}{4\,D\,B\,H^3} \text{ where,}$$

W equals the load corresponding to some point on the tangent,
D equals the deflection in inches corresponding to the same point,
B equals the breadth of beam in inches,
H equals the height of beam in inches,
L equals the span in inches.

After the cross-bending test, the beams were cut up, as shown in fig. 1, Plate II, for compression tests, shear tests, and moisture determinations. The parts which are marked C′ represent the blocks for tests in compression along the grain, and those which are marked S represent the pieces for shear tests. At A, B, and C thin disks were cut for moisture determination.

COMPRESSION ALONG THE GRAIN.

The blocks for tests in compression along the grain (Table II) were either 3½ by 3½ inches or 4 by 4 inches in cross section and 8 inches high. The machine was operated at a speed of 0.06 inch per minute and the load was increased until the blocks showed signs of failure by wrinkling on the sides.

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[a] Johnson, J. B.: Materials of construction, p. 19.

TABLE I.—*Cross-bending*

Name.	Locality.		Moisture over 35 per cent.						
			Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).
Lauan	Mindanao	Average	38	51.8	0.444	2,630	4,570	6,870	1,464
		Maximum		75	.485	5,340	5,840	7,[illegible]50	1,820
		Minimum		35.5	.405	1,410	3,160	5,340	975
Do	Zambales	Average	36	63	.478	5,260	6,410	8,040	1,438
		Maximum		86.4	.529	7,450	7,880	9,770	1,740
		Minimum		41.6	.412	2,810	4,510	4,510	1,050
Apitong	Mindanao	Average	52	53.9	.62	3,750	5,550	7,350	1,754
		Maximum		81	.715	6,330	8,720	10,550	2,580
		Minimum		36	.56	1,970	3,730	5,540	1,320
Do	Zambales	Average	30	55.8	.679	5,220	6,790	8,910	1,428
		Maximum		84.6	.721	7,030	8,430	10,470	1,740
		Minimum		48.8	.588	2,530	3,230	3,910	900
Guijo	Ambos Camarines.	Average	27	43.7	.677	6,330	8,660	12,050	1,915
		Maximum		56	.735	8,150	10,200	13,820	2,240
		Minimum		37.2	.629	4,920	7,180	10,380	1,635
Do	Mindoro	Average	49	57.8	.696	6,420	8,780	11,350	1,825
		Maximum		89.8	.806	9,140	11,450	14,200	2,210
		Minimum		41	.596	2,110	4,570	6,210	1,190
Molave	Near Laguna de Bay.	Average	47	45.5	.772	4,870	8,380	10,610	1,503
		Maximum		62	.858	9,150	13,600	14,600	2,000
		Minimum		36.4	.69	1,410	4,360	5,200	895
Do	Ambos Camarines.	Average	29	54.4	.782	6,840	8,640	10,380	1,381
		Maximum		72.5	.825	9,850	11,950	14,380	3,090
		Minimum		43.8	.712	2,100	2,460	3,820	1,050
Yacal	do	Average	21	43.3	.823	7,270	10,160	13,070	2,079
		Maximum		54.2	.906	9,850	11,600	15,350	2,650
		Minimum		35.3	.76	4,920	7,750	10,260	1,680
Narra	Near Laguna de Bay.	Average	11	79	.563	3,000	6,300	8,390	1,509
		Maximum		93	.59	4,500	8,100	11,300	1,850
		Minimum		65	.535	2,110	4,500	5,300	1,130
Do	Cagayan	Average	11	51.8	.63	6,020	7,960	10,220	1,352
		Maximum		81.7	.77	7,730	10,830	13,500	1,630
		Minimum		35.5	.475	4,360	6,050	7,190	1,050
Tanguile	Unknown	Average	8	39.9	.536	5,180	6,780	9,160	1,576
		Maximum		45.4	.565	5,900	7,600	10,210	1,685
		Minimum		35.5	.51	4,640	5,760	7,030	1,380
Do	Zambales	Average	27	47.7	.457	4,010	4,980	6,380	1,241
		Maximum		80	.54	5,620	7,170	9,450	1,660
		Minimum		38.9	.405	2,110	2,110	3,040	950
Sacat	Lamao Forest Reserve, Bataan.	Average	8	48.5	.561	3,340	5,030	6,960	1,584
		Maximum		54.4	.585	4,220	5,380	7,670	1,710
		Minimum		45.2	.54	2,110	4,120	4,840	1,340
Do	Tarlac	Average	42	55.2	.60	5,800	7,050	9,300	1,569
		Maximum		82.6	.657	7,740	9,000	12,450	1,920
		Minimum		35.3	.478	2,250	2,810	3,120	920
Ipil	Ambos Camarines.	Average	19	52.7	.79	4,360	6,690	7,960	1,295
		Maximum		76.1	.872	5,620	9,420	11,680	1,680
		Minimum		36.1	.68	2,670	5,620	5,620	1,000
Do	Mindoro	Average	44	63.1	.67	5,450	7,430	9,410	1,226
		Maximum		106	.77	9,150	10,820	13,640	1,840
		Minimum		35.6	.56	1,480	2,050	2,050	550
Do	Palawan	Average	41	52.2	.807	9,170	11,210	13,520	1,953
		Maximum		60.1	.867	12,220	13,750	17,000	2,210
		Minimum		46.6	.75	2,110	2,810	6,330	1,420
Dungon	Ambos Camarines.	Average	6	42.2	.824	5,660	7,400	11,770	1,680
		Maximum		66.4	.895	7,880	9,570	14,980	2,080
		Minimum		35.2	.723	1,410	2,540	4,370	1,050
Do	Masbate	Average	3	36.3	.827	4,730	6,420	10,250	1,593
		Maximum		37.2	.845	4,920	7,030	11,400	1,790
		Minimum		35.5	.816	4,360	5,620	8,640	1,470
Do.[a]	Mindanao	Average	21	49.4	.668	4,520	5,740	7,870	1,317
		Maximum		81.6	.707	5,900	6,890	9,520	1,690
		Minimum		35.5	.636	2,810	4,150	5,510	920
Malasantol	Unknown	Average	21	66.2	.633	4,500	6,480	8,690	1,518
		Maximum		84.5	.689	6,330	7,380	10,040	1,670
		Minimum		35.4	.608	2,810	5,280	5,870	1,420

[a] This is not the wood commonly known as Dungon but is often sold under that name.

strength of Philippine timber.

Moisture 20 to 35 per cent.							Moisture under 20 per cent.								
Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch.	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Total number of tests.	Specific gravity of dry wood, all tests.
	29.8	0.442	3,350	5,300	7,200	1,462		10.4	0.457	5,730	8,240	9,760	1,653		0.446
21	35	.47	6,190	7,740	8,920	1,790	14	17.5	.488	10,550	12,640	14,250	1,840	73	.488
	20	.40	1,550	3,520	4,220	1,050		3	.404	2,390	5,480	7,020	1,395		.40
															.478
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	36	.529
															.412
	26.8	.699	6,190	8,220	10,230	2,033		14	.706	7,340	9,760	11,620	2,144		.645
10	33.6	.74	9,150	9,850	11,640	2,550	13	19.8	.825	10,550	12,480	15,600	2,425	75	.825
	22	.658	4,220	6,320	8,600	1,710		9	.618	4,920	6,050	6,050	1,900		.56
	20.8	.93	2,950	4,150	5,100	1,000									.687
1	20.8	.93	2,950	4,150	5,100	1,000	.....	.....	.....	.....	.....	.....	.....	31	.93
	20.8	.93	2,950	4,150	5,100	1,000									.588
	26.6	.72	7,820	9,940	12,860	2,077		13.7	.759	10,080	12,850	15,150	2,158		.708
15	35	.776	9,850	12,380	14,600	2,370	13	18.6	.82	12,650	19,700	21,500	2,480	55	.82
	20.3	.673	4,920	7,800	10,540	1,660		7	.718	7,730	8,940	11,900	1,740		.629
	23.3	.724	7,740	9,150	12,650	2,110									.697
1	23.3	.724	7,740	9,150	12,650	2,110	.....	.....	.....	.....	.....	.....	.....	50	.806
	23.3	.724	7,740	9,150	12,650	2,110									.596
	31.8	.803	5,010	9,000	10,190	1,602		10.4	.824	8,240	8,580	8,580	1,614		.785
11	35	.848	7,030	10,700	12,150	1,950	9	19.5	.88	10,550	13,600	13,600	1,980	67	.88
	24.8	.725	3,520	7,740	9,530	1,400		3.5	.79	4,920	4,920	4,920	1,240		.69
															.782
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	29	.825
															.712
	29.6	.846	8,180	10,700	14,090	2,368		15.6	.848	9,650	12,130	15,690	2,583		.843
42	34.3	.94	11,250	13,600	17,650	2,870	17	19.8	.90	12,230	17,480	21,800	3,000	80	.94
	21.5	.77	4,220	5,480	7,700	1,680		11.4	.81	6,680	9,140	13,580	1,844		.76
															.563
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11	.59
															.535
	26.9	.508	5,650	6,570	7,380	1,462		9.6	.487	6,440	7,070	7,560	1,510		.54
7	32.7	.56	8,430	9,850	11,020	1,710	13	13.8	.531	10,550	10,680	11,730	1,670	31	.77
	22.9	.438	2,110	3,090	3,460	870		4.6	.384	2,810	2,810	2,960	1,050		.384
	30.6	.487	5,310	6,960	9,110	1,456		13.7	.422	6,440	7,380	8,360	1,232		.469
12	34.6	.524	6,740	7,600	10,230	1,685	16	18.7	.58	9,150	11,400	12,560	1,610	36	.58
	21.8	.38	4,220	6,190	7,030	1,050		5	.355	4,500	4,920	4,920	976		.355
	34.5	.54	6,050	6,330	7,700	1,320		9.7	.535	6,430	7,470	8,570	1,594		.491
1	34.5	.54	6,050	6,330	7,700	1,320	19	18.4	.606	10,550	11,520	13,220	1,950	47	.606
	34.5	.54	6,050	6,330	7,700	1,320		1.6	.478	2,110	2,110	2,300	1,120		.405
															.561
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8	.585
															.54
	24.2	.606	5,930	7,290	9,050	1,637		12.8	.664	8,350	9,610	11,440	1,886		.616
10	35	.677	7,600	9,140	12,470	1,900	16	19.3	.70	10,540	12,230	15,600	2,080	68	.70
	20.2	.485	2,110	2,390	4,220	1,160		4.2	.622	4,220	4,500	4,920	1,710		.478
	25.8	.783	5,580	6,640	7,900	1,470		18.1	.816	6,000	6,440	6,980	1,383		.792
14	34.6	.83	7,730	9,420	12,600	1,730	8	19.6	.99	7,580	7,740	9,040	1,630	41	.99
	21	.685	3,520	5,070	5,620	1,260		16	.713	4,780	4,780	4,780	1,180		.68
	34.5	.743	7,530	9,520	13,040	1,750									.673
2	34.5	.77	7,740	9,700	13,520	1,840	.....	.....	.....	.....	.....	.....	.....	46	.77
	34.4	.717	7,320	9,350	12,560	1,660									.56
															.807
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	41	.867
															.75
	26.4	.878	6,870	8,940	13,510	1,947		11.6	.845	10,160	13,460	17,110	2,209		.857
40	33.9	.924	9,850	11,400	16,900	2,260	26	17.6	.985	14,760	18,300	22,700	2,500	72	.985
	20	.788	3,800	5,910	7,900	1,240		6.5	.796	5,770	7,180	9,770	1,500		.723
	30.1	.854	4,960	6,910	10,600	1,442									.85
21	34.5	.89	6,330	8,440	13,150	1,900	.....	.....	.....	.....	.....	.....	.....	24	.89
	26.3	.822	3,520	4,220	7,260	1,050									.816
	30.7	.685	5,060	6,540	9,070	1,525									.669
2	31.9	.69	5,200	7,040	9,200	1,530	.....	.....	.....	.....	.....	.....	.....	23	.707
	29.5	.68	4,920	6,050	8,940	1,520									.636
	26.3	.663	5,840	7,180	10,310	1,595		12.1	.694	5,760	7,630	10,880	1,754		.646
2	27.1	.68	6,330	7,600	10,550	1,610	5	18.2	.712	7,730	9,000	13,540	2,290	28	.712
	25.6	.646	5,350	6,760	10,080	1,580		5.3	.66	3,520	4,220	4,800	1,320		.608

TABLE I.—*Cross-bending*

Name.	Locality.		Moisture over 35 per cent.						
			Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).
Supa	Unknown	Average	5	37.3	0.673	6,410	8,180	10,050	1,435
		Maximum		40.8	.692	8,440	8,870	11,150	1,530
		Minimum		35.6	.61	4,920	7,180	8,630	1,370
Do	Tayabas	Average	12	38.7	.755	4,890	7,170	8,700	1,415
		Maximum		46.7	.843	6,720	8,920	10,500	1,650
		Minimum		35.1	.70	2,810	4,920	6,490	1,160
Balacat	Lamao Forest Reserve, Bataan.	Average	9	56.1	.517	5,120	6,280	8,540	1,293
		Maximum		86	.57	6,190	6,750	9,200	1,450
		Minimum		45.7	.478	4,220	5,780	7,730	1,105
Do	Tarlac	Average	21	45.4	.56	5,210	6,200	7,780	1,221
		Maximum		59.8	.62	6,330	7,390	9,370	1,420
		Minimum		36.5	.515	3,520	3,940	4,790	870
Macaasin	Unknown	Average	35	68.4	.695	4,370	6,120	8,660	1,416
		Maximum		87.9	.734	8,440	8,790	10,880	1,750
		Minimum		36.3	.667	1,546	3,550	5,180	1,070
Calantas	Albay	Average	15	75.4	.357	3,000	4,240	5,650	961
		Maximum		94	.379	3,940	4,920	6,600	1,185
		Minimum		61	.336	1,970	3,100	4,400	738
Do	Mindoro	Average	10	57.3	.511	3,560	4,900	6,250	940
		Maximum		67	.54	5,620	6,180	7,950	1,160
		Minimum		38	.492	2,110	3,020	3,060	580
Tindalo	Unknown	Average	6	40.4	.747	8,090	10,770	15,000	2,226
		Maximum		44.6	.77	9,140	11,940	16,980	2,340
		Minimum		35.8	.734	6,330	8,430	12,300	2,050
Do	Ambos Camarines.	Average	12	44.7	.808	7,070	9,700	11,330	1,588
		Maximum		55	.86	10,400	12,400	14,200	1,750
		Minimum		37.7	.757	5,350	5,350	8,600	1,130
Do	Masbate	Average	10	59	.77	5,290	7,690	11,200	1,536
		Maximum		71.8	.813	7,460	9,480	13,240	1,710
		Minimum		50.7	.70	2,950	4,500	8,420	1,160
Amuguis	Mindoro	Average	31	46.1	.692	4,490	6,800	9,780	1,697
		Maximum		61.1	.76	9,110	9,300	12,670	2,160
		Minimum		35.7	.621	1,548	3,520	5,630	1,160
Acle	Tarlac	Average	41	92.5	.632	3,920	6,000	7,270	1,069
		Maximum		103	.707	5,280	7,730	8,920	1,395
		Minimum		77	.598	2,460	4,780	5,250	895
Do	Zambales	Average	6	96.8	.579	5,900	7,010	9,080	1,213
		Maximum		111	.604	7,030	8,720	11,560	1,360
		Minimum		83.6	.553	4,080	4,570	5,810	1,080
Betis	Tayabas	Average	7	38.1	.849	5,780	8,460	11,9[illegible]	1,768
		Maximum		42.5	.882	7,380	10,130	13,680	2,055
		Minimum		35.1	.82	3,160	6,330	10,010	1,293
Do	Ambos Camarines.	Average	30	61.6	.725	3,670	5,620	7,450	2,035
		Maximum		100	.798	5,240	7,750	9,340	2,400
		Minimum		45	.615	2,090	2,830	3,660	1,050
Bansalaguin	Unknown	Average	18	46.2	.841	6,820	9,420	11,740	1,702
		Maximum		57.8	.883	8,440	10,550	14,150	2,050
		Minimum		40	.784	3,800	7,310	9,510	1,480
Palo Maria	Zambales	Average	24	56	.623	5,840	7,040	8,930	1,461
		Maximum		105	.708	8,790	9,500	12,450	1,680
		Minimum		36.6	.488	2,950	4,080	5,500	810
Batitinan	Unknown	Average	10	54.4	.777	4,540	6,350	9,320	1,427
		Maximum		61.2	.795	5,620	7,600	10,600	1,630
		Minimum		49.1	.76	2,540	4,080	5,900	1,200
Aranga	Ambos Camarines.	Average	...	......	......	......	......	......	......
		Maximum							
		Minimum							
Banuyo	Masbate	Average	16	82	.522	2,900	4,170	5,140	881
		Maximum		115	.572	5,070	6,880	7,390	1,120
		Minimum		47.7	.455	1,400	2,860	4,080	575
Balacbacan	Occidental Negros.	Average	9	40	.538	5,410	6,320	8,180	1,280
		Maximum		45.8	.584	6,330	6,900	9,030	1,550
		Minimum		35.2	.481	4,220	4,500	5,960	1,090
Mayapis	Laguna	Average	20	67.7	.399	4,070	5,320	6,760	1,133
		Maximum		91	.456	4,920	6,330	8,300	1,420
		Minimum		48	.343	3,510	3,510	3,510	870

strength of Philippine timber—Continued.

Moisture 20 to 35 per cent.							Moisture under 20 per cent.								
Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Total number of tests.	Specific gravity of dry wood, all tests.
23	29.3	0.117	7,360	10,070	12,390	1,907	18	14.5	0.722	10,060	11,670	13,100	1,863	46	0.711
	34.4	.835	11,250	12,660	16,450	2,870		19.7	.808	15,500	15,800	16,850	2,280		.835
	20	.644	4,220	7,450	9,140	1,370		10.2	.625	7,040	7,730	7,810	1,475		.61
49	30.1	.827	5,280	7,520	9,050	1,510								61	.813
	34	.955	9,250	11,010	13,220	1,930	...	......	......	......	......	......	......		.955
	26.6	.712	1,680	2,410	3,230	750									.70
														9	.517
...	......	......	......	......	......	......	...	......	......	......	......	......	......		.57
															.478
7	26.6	.579	5,710	6,060	7,010	1,204	32	10.4	.589	6,050	7,600	8,270	1,271	60	.578
	30	.602	6,330	8,090	10,000	1,310		18.7	.66	8,440	11,250	11,720	1,520		.66
	24.1	.561	3,800	4,220	4,690	1,110		2.6	.54	4,220	4,670	4,670	1,080		.515
8	26.7	.77	5,200	8,130	10,560	1,778	4	15.7	.79	6,260	9,650	11,010	1,825	47	.717
	30.4	.81	5,910	10,400	13,130	1,950		19.1	.82	8,450	11,980	13,240	2,030		.82
	23	.734	3,870	6,330	8,940	1,630		12.3	.76	3,240	6,690	7,750	1,530		.667
							4	11.1	.363	5,300	7,260	8,980	1,255	19	.358
...	......	......	......	......	......	......		14.6	.37	6,320	8,160	9,300	1,340		.379
								8.6	.355	4,220	6,320	8,670	1,160		.336
8	28.9	.547	3,460	4,500	5,210	801								18	.527
	34.5	.583	4,920	6,330	7,200	1,050	...	......	......	......	......	......	......		.583
	23.7	.505	1,410	1,410	1,610	580									.492
4	28.9	.787	9,490	12,750	16,570	2,182								10	.763
	35.5	.864	11,250	14,340	17,650	2,230	...	......	......	......	......	......	......		.864
	23.3	.756	8,440	11,380	15,100	2,160									.734
16	26.6	.802	5,800	7,470	8,680	1,445	1	19.5	.808	7,180	9,140	11,200	1,570	29	.805
	33.4	.866	9,710	11,250	12,830	1,580		19.5	.808	7,180	9,140	11,200	1,570		.866
	20.6	.72	2,890	2,890	3,030	1,180		19.5	.808	7,180	9,140	11,200	1,570		.72
3	22.5	.785	6,370	8,160	9,050	1,273	5	18.9	.766	5,990	8,220	8,920	1,180	18	.772
	24.6	.788	7,020	8,300	10,000	1,320		19.9	.808	7,450	9,770	11,020	1,370		.813
	20.3	.784	5,340	8,080	8,080	1,180		17.7	.68	4,920	7,170	7,680	950		.68
1	33.6	.75	5,620	8,590	12,050	1,760								32	.694
	33.6	.75	5,620	8,590	12,050	1,760	...	......	......	......	......	......	......		.76
	33.6	.75	5,600	8,590	12,050	1,760									.621
5	27.9	.635	5,630	6,830	7,550	1,138	1	15.7	.684	3,660	4,920	5,400	880	20	.635
	34.5	.67	6,330	8,870	9,750	1,210		15.7	.684	3,660	4,920	5,400	880		.707
	21	.607	4,640	5,340	5,980	1,060		15.7	.684	3,660	4,920	5,400	880		.598
														6	.579
...	......	......	......	......	......	......	...	......	......	......	......	......	......		.604
															.553
13	31.8	.86	4,930	8,090	10,850	1,593								20	.856
	34.4	.886	7,380	10,550	14,060	1,950	...	......	......	......	......	......	......		.886
	27.1	.82	2,110	5,380	7,030	1,080									.82
1	34	.806	4,190	5,660	7,580	2,020								31	.728
	34	.806	4,190	5,660	7,580	2,020	...	......	......	......	......	......	......		.806
	34	.806	4,190	5,660	7,580	2,020									.615
1	33.3	.88	6,750	7,030	7,740	1,740	6	15.5	.87	8,670	11,870	14,480	2,311	25	.85
	33.3	.88	6,750	7,030	7,740	1,740		17	.905	10,250	13,350	18,200	2,530		.905
	33.3	.88	6,750	7,030	7,740	1,740		14.3	.85	6,330	8,780	12,400	2,100		.784
														24	.623
...	......	......	......	......	......	......	...	......	......	......	......	......	......		.708
															.488
							4	5	.836	6,850	8,400	9,630	1,655	14	.795
...	......	......	......	......	......	......		6.2	.85	8,860	11,100	12,300	1,910		.85
								4.1	.821	4,920	5,770	7,030	1,450		.76
19	31.4	.826	7,970	11,070	13,440	2,061	26	5.6	.882	12,530	16,230	17,920	2,419	45	.859
	34.8	.86	10,200	12,660	16,900	2,350		7.5	.942	16,880	21,350	24,450	2,800		.942
	29.3	.796	4,790	8,860	10,300	1,740		2.9	.832	7,740	9,850	11,630	2,000		.796
1	29.3	.52	4,220	5,340	5,940	1,105	3	17	.538	4,030	5,530	6,000	1,070	20	.525
	29.3	.52	4,220	5,340	5,940	1,105		18.9	.546	5,200	6,040	6,270	1,105		.572
	29.3	.52	4,220	5,340	5,940	1,105		13.4	.523	2,810	5,200	5,800	1,000		.455
5	22.8	.565	5,960	6,980	8,650	1,358	4	17.4	.533	6,190	7,400	9,000	1,550	18	.543
	25.5	.67	6,750	7,740	9,320	1,500		19.1	.54	6,890	8,170	9,440	1,770		.67
	20.7	.504	5,060	6,120	7,800	1,190		16.7	.525	5,060	6,750	8,380	1,330		.481
														20	.399
...	......	......	......	......	......	......	...	......	......	......	......	......	......		.456
															.343

TABLE I.—*Cross-bending*

Name.	Locality.		Moisture over 35 per cent.						
			Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).
Malugay	Mindoro	Average	18	57.2	0.635	4,780	6,930	10,280	1,627
		Maximum		72	.713	6,680	8,570	12,700	1,920
		Minimum		48.2	.553	2,810	5,200	6,900	1,290
Sasalit	Zambales	Average	...	......	......	......	......	......	......
		Maximum							
		Minimum							
Liusin	Bataan	Average	14	60.9	.71	5,430	8,120	11,360	1,896
		Maximum		63	.73	7,720	10,200	14,150	2,180
		Minimum		57.6	.70	2,390	5,900	7,160	1,340
Lumbayao	Basilan Island, Moro Province.	Average	2	37.1	.545	5,620	6,460	7,790	1,160
		Maximum		38.7	.56	6,740	6,890	8,060	1,210
		Minimum		35.5	.53	4,500	6,040	7,520	1,110

strength of Philippine timber—Continued.

Moisture 20 to 35 per cent.							Moisture under 20 per cent.							Total number of tests.	Specific gravity of dry wood, all tests.
Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch.	Modulus of elasticity (1,000 pounds per square inch).	Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).		
7	22.4	0.656	5,790	7,530	10,530	1,732	15	12	0.686	7,730	11,220	13,980	1,788	40	0.658
	26.4	.693	6,900	8,080	11,740	2,150		19.8	.75	9,850	14,900	19,830	2,180		.75
	21	.625	3,800	6,900	8,850	1,530		7.5	.62	4,090	6,810	10,040	1,480		.553
21	26.4	.901	9,990	11,420	14,050	2,120	18	12.4	.839	8,010	10,260	11,310	1,837	39	.872
	30.2	.995	13,350	15,480	18,720	2,480		19.2	.87	12,650	13,980	15,820	2,270		.995
	22	.742	7,030	7,460	8,770	1,240		9	.807	4,080	4,220	5,310	1,120		.742
														14	.71
......	......	......	......	......	......	......	......	......	......	......	......	......	......		.73
															.70
30	26.1	.552	6,550	7,620	10,090	1,416	22	12.7	584	7,800	9,110	11,390	1,570	54	.565
	33.9	.603	8,870	10,000	12,180	1,630		19.5	.671	10,140	12,380	14,920	1,870		.671
	20.5	.483	3,510	4,150	4,430	950		5.3	.53	4,220	4,220	7,810	1,340		.483

TABLE II.—*Compressive strength along*

Name.	Locality.		Moisture over 35 per cent.			
			Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).
Lauan	Mindanao	Average	67	52.4	0.444	3,840
		Maximum		73	.485	5,490
		Minimum		38.4	.408	3,262
Do	Zambales	Average	70	59.5	.478	4,180
		Maximum		76	.529	4,980
		Minimum		35.2	.412	3,220
Apitong	Mindanao	Average	98	53	.617	4,350
		Maximum		71.8	.715	5,740
		Minimum		36	.56	3,350
Do	Zambales	Average	60	53.4	.679	5,010
		Maximum		93	.721	5,710
		Minimum		46.4	.588	2,810
Guijo	Ambos Camarines	Average	50	41.8	.675	6,070
		Maximum		59.6	.73	6,610
		Minimum		36	.629	5,180
Do	Mindoro	Average	98	55.7	.697	6,070
		Maximum		79.6	.806	7,300
		Minimum		40.9	.596	3,660
Molave	Near Laguna de Bay	Average	78	46.4	.772	6,680
		Maximum		66	.85	8,470
		Minimum		37	.69	4,770
Do	Ambos Camarines	Average	50	50.5	.784	6,530
		Maximum		61.5	.822	8,300
		Minimum		40.3	.712	3,900
Yacal	do	Average	34	46.7	.828	7,490
		Maximum		75	.85	8,400
		Minimum		38.6	.77	6,200
Narra	Near Laguna de Bay	Average	20	77.7	.563	5,780
		Maximum		93	.69	6,900
		Minimum		66.5	.535	4,180
Do	Cagayan	Average	18	55.9	.619	5,300
		Maximum		75.5	.68	6,530
		Minimum		35.5	.482	3,770
Tanguile	Unknown	Average	18	40.5	.53	4,750
		Maximum		47.4	.565	5,270
		Minimum		35.2	.47	3,650
Do	Zambales	Average	54	44.1	.46	3,980
		Maximum		58.6	.54	4,780
		Minimum		35.6	.405	3,050
Sacat	Bataan	Average	14	49.8	.561	4,530
		Maximum		53.8	.585	4,740
		Minimum		46.2	.54	4,280
Do	Tarlac	Average	74	53.1	.60	5,260
		Maximum		89.7	.657	9,150
		Minimum		35.2	.478	3,140
Ipil	Ambos Camarines	Average	36	52.9	.796	5,650
		Maximum		78.7	.872	6,390
		Minimum		43.5	.714	4,980
Do	Mindoro	Average	84	60.4	.666	5,450
		Maximum		89	.75	7,150
		Minimum		37.5	.56	2,390
Do	Palawan	Average	79	51.4	.807	8,090
		Maximum		61.2	.867	9,470
		Minimum		44.8	.75	5,350
Dungon	Ambos Camarines	Average	6	44.1	.803	6,160
		Maximum		58	.846	6,520
		Minimum		37.1	.723	5,900
Do	Masbate	Average	6	36.9	.825	4,540
		Maximum		37.5	.84	5,030
		Minimum		36.2	.816	3,830
Do.[a]	Mindanao	Average	38	50.7	.669	4,000
		Maximum		82	.707	4,740
		Minimum		35.5	.636	3,080
Malasantol	Unknown	Average	40	64.4	.631	4,660
		Maximum		86	.68	5,410
		Minimum		37.4	.608	3,390
Supa	do	Average	8	36.1	.677	6,480
		Maximum		36.3	.692	7,030
		Minimum		36	.644	5,750
Do.	Tayabas	Average	10	37.2	.746	5,090
		Maximum		41.6	.855	6,090
		Minimum		35.1	.70	3,770
Balacat	Lamao Forest Reserve, Bataan.	Average	16	52.6	.517	4,020
		Maximum		61.6	.57	4,510
		Minimum		39.5	.478	3,540

[a] This is not the wood commonly known as Dungon but is often sold under that name.

the grain of Philippine timber.

Moisture 20 to 35 per cent.				Moisture under 20 per cent.				Total number of tests.	Specific gravity of dry wood, all tests.
Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).	Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).		
40	30.5	0.44	4,040	32	12.4	0.458	6,180	139	0.448
	35	.47	4,550		19.4	.488	9,270		.488
	25	.40	3,470		3.3	.404	4,730		.40
								70	.470
									.529
									.412
24	27.2	.711	5,740	28	14.4	.688	7,250	150	.645
	34	.825	6,770		19.4	.735	9,400		.825
	20	.664	4,740		7.8	.618	5,270		.56
				2	15.2	.93	4,190	62	.687
					15.2	.93	4,220		.93
					15.2	.93	4,160		.588
24	28.8	.719	6,160	36	14.6	.748	7,940	110	.708
	35	.76	7,220		19.8	.82	11,400		.82
	23.2	.673	4,900		7.5	.68	3,980		.629
								98	.697
									.806
									.596
20	29.7	.794	7,080	17	12.7	.818	8,330	115	.783
	34.6	.858	8,800		18.8	.88	10,300		.88
	20.2	.725	6,100		5.2	.728	6,800		.69
								50	.784
									.822
									.712
94	29.5	.832	8,340	29	13.4	.849	9,220	157	.843
	35	.94	9,510		18.1	.90	11,280		.94
	21.8	.76	6,250		10.7	.814	7,580		.76
								20	.563
									.59
									.535
18	28.5	.534	5,290	24	7.5	.484	6,740	60	.54
	34.2	.77	7,060		9.7	.531	8,600		.77
	21.1	.438	4,160		4.8	.384	4,540		.384
22	30.6	.485	5,030	32	13.7	.424	5,230	72	.469
	35	.52	5,450		19.9	.58	6,521		.58
	27.2	.355	3,752		8.8	.376	3,825		.355
				38	9.6	.535	6,900	92	.491
					19.2	.604	8,670		.606
					1.7	.478	4,150		.405
								14	.561
									.585
									.54
22	26.6	.592	5,500	38	12.4	.661	7,140	134	.616
	34.8	.677	5,910		19.7	.70	9,020		.70
	20	.485	3,990		4.2	.601	4,970		.478
30	25.9	.779	6,250	16	17.7	.807	6,570	82	.792
	31.7	.855	7,600		19.9	.99	8,020		.99
	21.6	.68	4,280		14.8	.713	3,650		.68
4	32.5	.77	6,030	2	19.8	.77	6,540	90	.673
	33.4	.77	6,470		19.8	.77	6,570		.77
	31.5	.77	5,530		19.8	.77	6,510		.56
								79	.807
									.867
									.75
54	25.2	.88	6,440	48	10.7	.839	9,420	108	.858
	34	.985	7,970		16.4	.882	11,970		.985
	20	.788	4,050		8	.796	6,410		.723
40	29.5	.854	4,690					46	.85
	34.8	.89	6,670						.89
	25.1	.822	3,460						.816
6	32.6	.67	4,600					44	.669
	35	.69	5,200						.707
	29	.657	4,090						.636
4	30.7	.684	4,840	10	13.5	.694	6,580	54	.646
	34.3	.689	5,040		17.1	.712	8,040		.712
	27.2	.679	4,660		10	.66	5,140		.608
42	30.2	.711	7,100	42	14.5	.713	8,700	92	.711
	33.4	.835	8,510		19.5	.808	10,340		.835
	26	.61	5,790		8.3	.625	7,046		.61
112	28.3	.819	5,980					122	.813
	34.7	.955	7,700						.955
	22.5	.712	4,000						.70
								16	.517
									.57
									.478

TABLE II.—*Compressive strength along the*

Name.	Locality.		Moisture over 35 per cent.			
			Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).
Balacat	Tarlac	Average	40	44.7	0.56	4,150
		Maximum		63	.62	4,710
		Minimum		36.8	.515	2,920
Macaasin	Unknown	Average	76	63.9	.703	4,350
		Maximum		81.5	.81	6,260
		Minimum		35.2	.667	2,610
Calantas	Albay	Average	28	77.3	.357	2,960
		Maximum		89.6	.379	3,450
		Minimum		62.9	.336	2,330
Do	Mindoro	Average	18	57.3	.51	3,810
		Maximum		64.7	.54	4,960
		Minimum		46	.492	3,230
Tindalo	Unknown	Average	12	41.9	.747	7,400
		Maximum		44.8	.77	9,150
		Minimum		38.3	.734	5,620
Do	Ambos Camarines	Average	23	43.9	.80	7,140
		Maximum		58.1	.86	8,960
		Minimum		37	.72	5,850
Do	Masbate	Average	20	56.7	.77	5,930
		Maximum		70.1	.813	7,030
		Minimum		50.7	.70	4,270
Amuguis	Mindoro	Average	54	45.2	.692	5,210
		Maximum		57.8	.76	6,490
		Minimum		36	.621	2,660
Acle	Tarlac	Average	27	84.5	.631	4,550
		Maximum		101	.707	5,440
		Minimum		39.2	.598	3,790
Do	Zambales	Average	12	94.9	.579	5,330
		Maximum		106	.604	5,880
		Minimum		81	.553	4,900
Betis	Tayabas	Average	14	38.2	.854	6,540
		Maximum		42.7	.882	7,540
		Minimum		31.6	.82	5,640
Do	Ambos Camarines	Average	60	59.5	.725	4,330
		Maximum		79.3	.798	4,930
		Minimum		42.8	.615	3,380
Bansalaguin	Unknown	Average	34	43	.841	6,960
		Maximum		53.6	.88	8,140
		Minimum		35.1	.784	5,410
Palo-Maria	Zambales	Average	40	50.2	.618	4,770
		Maximum		103	.704	6,220
		Minimum		35.1	.488	3,150
Batitinan	Unknown	Average	18	54.9	.777	4,650
		Maximum		61.6	.795	5,180
		Minimum		48.5	.76	3,950
Aranga	Ambos Camarines	Average	....	....	....	....
		Maximum				
		Minimum				
Banuyo	Masbate	Average	30	77.9	.527	3,290
		Maximum		110	.572	4,470
		Minimum		35.3	.46	2,550
Balacbacan	Negros Occidental	Average	4	43	.546	4,410
		Maximum		46.6	.578	4,640
		Minimum		39.5	.514	4,160
Mayapis	Laguna	Average	40	63.5	.399	3,530
		Maximum		85.4	.456	4,080
		Minimum		44.1	.343	2,780
Malugay	Mindoro	Average	34	55.8	.635	5,120
		Maximum		70.8	.713	6,040
		Minimum		46.6	.553	3,960
Sasalit	Zambales	Average	....	....	....	....
		Maximum				
		Minimum				
Liusin	Bataan	Average	8	60.9	.71	5,220
		Maximum		63	.73	5,640
		Minimum		57.6	.70	4,860
Lumbayao	Basilan Island, Moro Province.	Average	....	....	....	....
		Maximum				
		Minimum				

grain of Philippine timber—Continued.

Moisture 20 to 35 per cent.				Moisture under 20 per cent.				Total number of tests.	Specific gravity of dry wood, all tests.
Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).	Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).		
12	24.9	0.588	4,650	66	9.8	0.587	5,530	118	0.578
	30.7	.66	5,320		19.2	.638	7,590		.66
	20	.561	3,770		2.2	.54	4,020		.515
10	26.2	.776	5,880	6	17.1	.793	6,860	92	.717
	30.5	.78	6,600		18	.82	7,650		.82
	20	.774	4,960		15.7	.76	5,980		.667
....	....	....	....	8	9.7	.363	4,420	36	.358
					12.8	.37	4,830		.379
					7.1	.355	3,230		.336
12	26.3	.537	3,820	6	12.5	.557	3,520	36	.527
	32.2	.583	4,320		19.1	.573	4,360		.583
	23.8	.505	3,360		9.1	.531	2,890		.492
8	28.8	.787	8,770	....	....	....	....	20	.763
	32.4	.864	9,680						.864
	23.6	.756	6,890						.734
26	27.4	.806	7,310	6	16.9	.819	7,710	55	.805
	32.7	.866	9,040		17.6	.83	8,650		.866
	22.5	.742	3,530		15.7	.802	7,040		.72
8	22	.753	6,340	8	18.6	.794	6,780	36	.772
	23	.788	7,350		19.4	.808	7,660		.813
	20.1	.68	5,150		16.9	.784	5,950		.68
6	32.9	.707	4,920	....	....	....	....	60	.693
	34.8	.75	6,140						.76
	30	.641	3,980						.621
10	30.2	.647	5,050	....	....	....	....	37	.635
	34	.684	5,820						.707
	25	.607	4,400						.598
....	....	....	....	....	....	....	....	12	.579
									.604
									.553
24	31.5	.857	6,410	....	....	....	....	38	.856
	34.8	.886	7,330						.886
	28.3	.82	5,000						.82
2	34	.806	4,410	....	....	....	....	62	.728
	34	.806	4,540						.806
	34	.806	4,290						.615
2	32.8	.883	7,140	12	14.5	.87	8,630	48	.85
	32.8	.883	7,310		16.5	.905	9,560		.905
	32.8	.883	6,980		12.1	.85	7,800		.784
2	34.2	.674	5,720	....	....	....	....	42	.623
	35	.708	6,240						.708
	33.4	.64	5,340						.488
....	....	....	....	8	5	.836	9,290	26	.795
					5.6	.85	10,640		.85
					4.4	.821	7,190		.76
36	31.2	.826	8,020	52	4.9	.882	12,420	88	.859
	34.5	.86	8,730		6.4	.942	14,920		.942
	27.7	.796	6,840		3.4	.832	9,290		.796
4	24.2	.50	3,990	4	15.5	.534	4,150	38	.525
	28	.546	4,470		17.8	.545	4,470		.572
	20.5	.455	3,400		13.3	.523	3,530		.455
20	28.8	.544	4,720	10	17.4	.539	5,220	34	.543
	35	.67	5,540		19.9	.56	5,660		.67
	20.4	.481	3,980		14.8	.525	4,530		.481
....	....	....	....	....	....	....	....	40	.399
									.456
									.343
18	22.1	.666	5,740	26	11.2	.683	8,080	78	.658
	35.9	.71	7,270		18.8	.75	10,930		.75
	20	.625	5,160		7.4	.62	4,830		.553
42	25.7	.89	9,290	34	11.3	.849	9,100	76	.872
	31.1	.984	11,890		15.8	.995	11,180		.995
	21.5	.742	6,600		8.7	.815	6,400		.742
....	....	....	....	....	....	....	....	8	.71
									.73
									.70
54	25.2	.551	5,480	52	12.5	.58	6,410	106	.565
	31.5	.603	6,390		19.7	.671	8,100		.671
	20.1	.483	4,520		5.3	.53	3,550		.483

SHEAR ALONG THE GRAIN.

The form of the piece used for shear tests is shown in fig. 2, Plate II. The pieces were either 1½ or 1¾ inches thick, 3 inches wide, and 18 inches long. Just 1 inch from one end of the piece a hole was cut five-eighths inch by 1 inch, through which a rectangular steel bar was placed. The opposite end of the test piece was then gripped in the upper jaws of the machine and the load was applied on the steel bar until the material directly under it was sheared out. It will be seen that this arrangement produces double shear, the area being either 3 or 3½ square inches, depending upon the thickness of the piece. For these tests the machine was operated at a speed of 0.3 inch per minute.

TABLE III.—*Shearing strength along the grain of Philippine timber.*

[Results averaged regardless of moisture content.]

Name.	Locality.		Number of tests.	Specific gravity, dry wood.	Stress at rupture (pounds per square inch).
Lauan	Mindanao	Average	142	0.446	557
		Maximum		.488	934
		Minimum		.40	326
Do	Zambales	Average	69	.478	525
		Maximum		.529	873
		Minimum		.412	292
Apitong	Mindanao	Average	150	.645	669
		Maximum		.825	1,203
		Minimum		.56	240
Do	Zambales	Average	62	.687	757
		Maximum		.93	1,212
		Minimum		.588	298
Guijo	Ambos Camarines	Average	110	.708	915
		Maximum		.82	1,324
		Minimum		.629	366
Do	Mindoro	Average	98	.697	824
		Maximum		.806	1,500
		Minimum		.596	561
Molave	Near Laguna de Bay	Average	129	.784	914
		Maximum		.88	1,362
		Minimum		.69	357
Do	Ambos Camarines	Average	51	.784	839
		Maximum		.825	1,323
		Minimum		.716	403
Yacal	do	Average	150	.843	849
		Maximum		.94	1,665
		Minimum		.76	427
Narra	Near Laguna de Bay	Average	20	.563	678
		Maximum		.59	844
		Minimum		.535	456
Do	Cagayan	Average	59	.54	660
		Maximum		.77	1,225
		Minimum		.384	291
Tanguile	Unknown	Average	70	.471	647
		Maximum		.58	928
		Minimum		.355	326
Do	Zambales	Average	86	.491	555
		Maximum		.606	1,068
		Minimum		.405	288
Sacat	Lamao Forest Reserve, Bataan.	Average	14	.561	776
		Maximum		.585	1,055
		Minimum		.54	550
Do	Tarlac	Average	132	.616	850
		Maximum		.70	1,584
		Minimum		.478	466
Ipil	Ambos Camarines	Average	79	.793	904
		Maximum		.99	1,310
		Minimum		.68	458
Do	Mindoro	Average	90	.673	948
		Maximum		.77	1,445
		Minimum		.56	410
Do	Palawan	Average	80	.807	753
		Maximum		.867	1,226
		Minimum		.75	525
Dungon	Ambos Camarines	Average	98	.852	1,253
		Maximum		.985	1,854
		Minimum		.723	672
Do	Masbate	Average	46	.85	1,298
		Maximum		.89	1,560
		Minimum		.816	925
Do.[a]	Mindanao	Average	44	.669	855
		Maximum		.707	1,102
		Minimum		.636	563
Malasantol	Unknown	Average	54	.646	720
		Maximum		.712	1,110
		Minimum		.608	409

[a] This is not the wood commonly known as Dungon, but is often sold under that name.

TABLE III.—*Shearing strength along the grain of Philippine timber*—Continued.

Name.	Locality.		Number of tests.	Specific gravity, dry wood.	Stress at rupture (pounds per square inch).
Supa	Unknown	Average	86	0.71	898
		Maximum		.835	1,480
		Minimum		.61	520
Do	Tayabas	Average	118	.813	852
		Maximum		.955	1,380
		Minimum		.70	293
Balacat	Lamao Forest Reserve, Bataan.	Average	16	.517	486
		Maximum		.57	638
		Minimum		.478	300
Do	Tarlac	Average	117	.578	692
		Maximum		.66	1,281
		Minimum		.515	253
Macaasin	Unknown	Average	92	.717	916
		Maximum		.82	1,390
		Minimum		.667	376
Calantas	Albay	Average	34	.358	526
		Maximum		.379	870
		Minimum		.336	289
Do	Mindoro	Average	35	.527	778
		Maximum		.583	1,049
		Minimum		.492	455
Tindalo	Unknown	Average	20	.763	1,004
		Maximum		.864	1,460
		Minimum		.734	685
Do	Ambos Camarines	Average	56	.805	911
		Maximum		.866	1,507
		Minimum		.72	299
Do	Masbate	Average	36	.772	905
		Maximum		.813	1,226
		Minimum		.68	496
Amuguis	Mindoro	Average	60	.692	824
		Maximum		.75	1,762
		Minimum		.621	396
Acle	Tarlac	Average	36	.63	686
		Maximum		.707	1,270
		Minimum		.598	420
Do	Zambales	Average	11	.579	778
		Maximum		.604	1,190
		Minimum		.553	443
Betis	Tayabas	Average	38	.856	1,168
		Maximum		.886	1,555
		Minimum		.82	598
Do	Ambos Camarines	Average	61	.728	819
		Maximum		.806	1,243
		Minimum		.615	474
Bansalaguin	Unknown	Average	48	.85	1,098
		Maximum		.905	1,865
		Minimum		.784	695
Palo Maria	Zambales	Average	46	.623	856
		Maximum		.708	1,581
		Minimum		.488	528
Batitinan	Unknown	Average	26	.795	859
		Maximum		.85	2,195
		Minimum		.76	535
Aranga	Ambos Camarines	Average	82	.863	1,038
		Maximum		.942	2,324
		Minimum		.796	355
Banuyo	Masbate	Average	38	.525	596
		Maximum		.572	1,065
		Minimum		.455	287
Balacbacan	Negros Occidental	Average	34	.543	689
		Maximum		.67	1,048
		Minimum		.481	423
Mayapis	Laguna	Average	40	.399	472
		Maximum		.456	790
		Minimum		.343	288
Malugay	Mindoro	Average	78	.658	980
		Maximum		.75	1,885
		Minimum		.553	464
Sasalit	Zambales	Average	75	.872	1,176
		Maximum		.995	1,938
		Minimum		.742	708
Liusin	Bataan	Average	8	.71	886
		Maximum		.73	1,388
		Minimum		.70	543
Lumbayao	Basilan Island, Moro Province.	Average	104	.565	827
		Maximum		.671	1,306
		Minimum		.483	353

COMPRESSION ACROSS THE GRAIN.

Compression across the grain, as it usually occurs in practice, is a combination of simple compression over a given area, and shearing and bending of the material along the edges of that area. It was desired, if possible, to determine just what part of the load went into simple compression and what part was used in shearing and bending the material along the edges of the area compressed. The following method was adopted and has proven very satisfactory.

Pieces 4 by 4 inches by 6 feet were used. The piece to be tested was laid upon the table of the machine and the load was applied to cast-iron blocks laid across the test piece. (See fig. 3, Plate II.) Two tests were made upon each piece; one with an iron block 2 inches wide and one with an iron block 6 inches wide, the material under the iron block being compressed 0.6 inch unless it showed a decided point of failure before that deflection was reached. If no point of failure could be detected, 0.6 inch deflection was assumed arbitrarily as the point of failure.

Let W equal the load necessary to apply on the 6-inch block to produce a given deflection, and let W′ equal the load necessary to apply on the 2-inch block to produce the same deflection, then $W-W'$ equals the load which would produce that deflection upon an area 4 by 4 inches by simple compression—that is, without the support usually given by the material along the edges of the area over which the load is applied; therefore, $\frac{W-W'}{16}$ equals the stress of simple compression in pounds per square inch. This quantity will be called P.

Now, to determine the part of the load which is used in bending the material along the edges, the test with the 2-inch block will be considered.

The area under compression is 8 square inches; therefore, 8P equals the part of the load which produces simple compression, and since W′ equals the total load applied, $W'-8P$ equals the part of the load which bends and shears the fiber along the edges of the block, and $\frac{W'-8P}{8}$ equals the stress in pounds per linear inch, which produces bending and shearing of the fibers and will be called p.

For small deflections and large areas, p may usually be neglected, but it increases rapidly as the deflection increases, and for large deflections and small areas which have their greater dimension extending across the grain, p is a very important factor, often much more important than P. P and p are very nearly independent of the area under consideration, and may therefore be used in all ordinary cases of compression across the grain.

In the following plates values of P are represented by curves A, and values of p by curves B. All specimens which were tested were clear and sound.

MOISTURE DETERMINATIONS.

As previously stated, moisture disks were cut at A, B, and C. (See fig. 1, Plate II.) These disks were about three-eighths of an inch thick. They were weighed as soon as cut and then placed in a small, steam dry kiln, having a temperature of 110° C., until they were dried to constant weight and then weighed again. The difference between the original weight and the weight after drying was considered as the weight of the moisture, and the percentage of moisture was determined with reference to the dry weight.

SPECIFIC GRAVITY.

In all cases the specific gravity was determined from the full-sized beam. After the moisture content was determined at A, B, and C (see fig. 1, Plate II), the results were averaged to obtain the average percentage of moisture for the entire beam and the specific gravity was determined for dry wood. For this paper, the following arbitrary classification for heaviness is made: Light, less than 0.50; moderately heavy, 0.50 to 0.70; heavy, 0.70 to 0.90; very heavy, over 0.90. Thus Lauan would be classed as light; Apitong, moderately heavy; Yacal, heavy; and Ebony, very heavy.

HARDNESS.[a]

While hardness is an important property of all materials of construction and has received considerable attention by technologists, there is great diversity of opinion as to how this property shall be defined, tested, and measured. No measure of hardness has yet been proposed which is entirely satisfactory for all materials. The wood worker says a wood is hard if it resists penetration by wood-working tools. This is probably as satisfactory a definition as can be given, and the tests made by this bureau are based upon this conception of hardness. For lack of a better method, a scale of hardness for woods has been arranged in the following manner: Representative samples of the various species were selected for this test. The pieces were seasoned and one surface of each was carefully smoothed. Across the grain of each smoothed surface a hardened steel point was drawn, with a pressure of 3.3 pounds. The depth of the scratch produced was considered a measure of hardness. On such woods as Ebony and Bansalaguin the steel point had very little effect, while on California Redwood and Calantas it made a ragged scratch one thirty-second of an inch or more in depth. No claim is made for great accuracy by the above method, and it is possible that the order of hardness may be altered slightly if a more satisfactory test can be devised.

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[a] For discussion of hardness of materials and hardness test, see Martens's Handbook of Testing Materials, p. 288.

California Redwood and Oregon Pine are placed in the following list to give an idea of the relative hardness of American and Philippine woods:

Woods arranged in order of hardness.

Museum No.	Kind of wood.	Remarks.	Museum No.	Kind of wood.	Remarks.
1001	Ebony	Very hard.	1024	Supa	Hard.
1003	Bansalaguin	Do.	1027	Acle	Do.
1004	Sasalit	Do.	......	Apitong	Moderately hard.
1005	Liusin	Do.	1031	Malasantol	Do.
1006	Betis	Do	1037	Banuyo	Do.
1007	Dungon	Do.	1038	Tanguile	Do.
1010	Aranga	Do.	1040	Sacat	Do.
1011	Guijo	Hard.	1041	Narra	Do.
1013	Tindalo	Do.	1043	Lumbayao	Soft.
1014	Yacal	Do.	1044	Balacat	Do.
1015	Molave	Do.	1046	Oregon Pine	Do.
1016	Batitinan	Do.	1047	Lauan	Do.
1017	Macaasin	Do.	1049	Mayapis	Do.
1019	Amuguis	Do.	1053	Balacbacan	Very soft.
1020	Palo Maria	Do.	1054	California Redwood	Do.
1021	Ipil	Do.	1056	Calantas	Do.
1023	Malugay	Do.			

STRUCTURAL QUALITIES, APPEARANCE, USES, PROVINCES LEADING IN PRODUCTION, SIZES, AND COMMON AND BOTANICAL NAMES.[a]

LAUAN.

Structural qualities.—Lauan is a light and soft wood that takes a fair polish. It is not durable in the ground or when exposed to the sun and the rain. It seasons well, is usually free from defects, and is not inclined to split or check.

Appearance, color, and grain.—Both the heartwood and sapwood of Lauan are nearly white. The wood has a straight but rather coarse grain.

Uses.—Lauan is used in light and temporary construction. It is also used in cabinetmaking, in inferior furniture, and for small boats.

Provinces leading in production.—Negros Occidental, Bulacan, Bataan, Leyte, and Zambales.

Sizes.—On a coastal plain in Mindoro the average diameter of 575 trees over 16 inches (40 centimeters) of Lauan (*Shorea contorta* Vid.) is 26 inches (66 centimeters). On the lower slopes of Mount Silay, in Negros Occidental, the average diameter of 885 trees over 16 inches (40 centimeters) of Almon is 28 inches (71 centimeters). The average merchantable length of 15 measured trees of this species is 88 feet (27 meters). The Lauan of Tayabas has a maximum diameter of 35 inches (89 centimeters) and a clear length of 102 feet (31 meters).

Common names.[b]—T., Lauan, Lauaan, Bayucan, Sandana; Cag., Balabas; Il.,

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[a] All information here given regarding sizes and common and botanical names was collected and arranged by H. N. Whitford, forester, chief of the division of forest products.

[b] In connection with the common names, the dialects of the names, or the provinces where they are used, are shown by the following abbreviations: T., Tagalog; Cag., Cagayan; Il., Ilocano; Pamp., Pampanga; Neg., Negrito; V., Visayan; B., Bicol; N. V., Nueva Viscaya; Isa., Isabela; Pang., Pangasinan; Z., Zambales.

Apuit Duyong, Ligamen, Anting, Bayucan; Pamp., Lauayan; Neg., Bayucan; V., Lauaan; B., Malasinoro, Hapnit.

Remarks.—Several different kinds of woods are marketed under the name of Lauan. They are classified as red and white Lauan. The red Lauans are allied to Balacbacan and Tanguile in structural qualities. (See under these names.) There are at least two white Lauans. *Shorea contorta* Vid., found in the provinces of Mindoro, Bataan, and Zambales, is the true white Lauan. *Shorea squamata* from the island of Negros is known under the Visayan name of Almon or Lauaan. It is probable that the true Lauan (*Shorea contorta*) and Almon (*Shorea squamata*) are known on the market from other provinces under other names.

APITONG.

Structural qualities.—Apitong is a moderately heavy, hard wood that is fairly durable and usually clear and sound. It shrinks considerably in drying, but does not check badly.

Appearance, color, and grain.—Apitong has a reddish color. It is straight but rather coarse grained.

Uses.—Apitong is used in ordinary construction, in shipbuilding, and for inferior furniture.

Provinces leading in production.—Bataan, Zambales, Negros Occidental, Ambos Camarines, Tayabas, Bulacan, and Mindoro.

Sizes.—On a coastal plain in Mindoro the average diameter of 73 trees over 16 inches (40 centimeters) of Apitong (*Dipterocarpus* sp.) is 26 inches (67 centimeters). In Negros the average diameter of 1,051 trees over 16 inches (40 centimeters) is 24 inches (60 centimeters), and the average merchantable length of 13 measured trees is 62 feet (19 meters). These dimensions are for *D. grandiflorus* Blanco. The sizes given are thought to be low, for a large percentage of the Negros trees measured had been injured by tapping for resin.

The Apitong (species not known) of Tayabas has a maximum clear length of 100 feet (30 meters) and a maximum diameter of 45 inches (114 centimeters).

On a coastal plain in Mindoro the average diameter of 161 trees over 16 inches (40 centimeters) of Hagachac (*Dipterocarpus lasiopodus* Perk.) is 26 inches (67 centimeters). In a similar habitat in Baler, Tayabas, the average diameter of all the trees on 31 acres, 8 inches (20 centimeters) and over, of Hagachac is 21 inches (53 centimeters). The maximum diameter is 53 inches (134 centimeters), and the average clear length is 86 feet (26 meters).

Common names.—Apitong: T., Apitong, Hapiton, Apiton, Balao; B., Anahaon; V., Hapitan, Mapitan; Cag., Camuyao, Duco; Il., Canunyao. Panao: T. Bulay (Batangas), Balao, Malapao, Malapaho, Panao, Panuo. Hagachac: T., Hagachac.

Remarks.—At least four species are placed on the market as Apitong. They are the true Apitong (*Dipterocarpus grandiflorus* Blanco), Panao (*Dipterocarpus verniciflu̇us* Blanco), Hagachac (*Dipterocarpus lasiopodus* Perk.), and an undescribed species from Mindoro that has the common name of Apitong (*Dipterocarpus* sp.). The woods of these four species differ but little in appearance.

Better grades of Apitong are sometimes sold as Guijo.

GUIJO.

Structural qualities.—The wood of Guijo is moderately heavy, hard, strong, brittle, fairly durable, and usually free from defects. It is inclined to warp and check in drying.

Appearance, color, and grain.—Guijo has an ashy red color and is straight grained.

Uses.—Guijo is used in general construction and shipbuilding, for carriage wheels and shafts, for flooring and girders of houses, and for inferior furniture.

Provinces leading in production.—Mindoro, Tayabas, Leyte, Ambos Camarines, Misamis, and Sorsogon.

Sizes.—On a coastal plain in Mindoro the average diameter of 168 trees over 16 inches (40 centimeters) of *Shorea guiso* Blume is 25 inches (63 centimeters). For Baler, Tayabas, the average diameter for trees over 8 inches (20 centimeters) of Guisoc, measured on 81 acres, is 13 inches (33 centimeters), the maximum diameter 35 inches (89 centimeters), and the average clear length 39 feet (12 meters). In southern Tayabas there is a reported maximum diameter for Guijo of 40 inches (101 centimeters) and a maximum clear length of 88 feet (27 meters).

Common names.—T., Guiso, Guijo, Guisóc, Guisihang, Betic (Laguna); Cag., Sáray, Zitan; N. V., Cotópang, Curucat, Curyao; Il., Yamban, Niquet, Zimaya, Saray, Zilan; B., Guisoc, Guiso, Yamban; Pamp., Yamban.

Remarks.—So far as is known, there is only one species placed on the market as Guijo. This is *Shorea guiso* Blume, though better grades of Apitong are sometimes sold as Guijo.

MOLAVE.

Structural qualities.—The wood of Molave is hard, heavy, and brittle. It is almost impervious to decay and is not attacked by the anay (white ant). It checks slightly in seasoning. Heart checks and small knots are quite frequent.

Appearance, color, and grain.—The heartwood of Molave is pale yellow and the sapwood is only slightly lighter in color. The wood is very fine and usually cross-grained.

Uses.—The wood of Molave is most highly valued for general building purposes, where durability is essential. It is used in shipbuilding; for posts, sleepers, and interior trim of houses; and in cabinetmaking and turnery.

Provinces leading in production.—Tayabas, Leyte, Misamis, Negros Occidental, Ambos Camarines, Cagayan, and Iloilo.

Sizes.—There is a reported maximum diameter of 45 inches (114 centimeters) and a maximum clear length of 24 feet (7.3 meters) for Molave in Tayabas. The tree is usually irregular in shape, with heavy large branches, a part of which may be utilized.

Common names.—Spanish-Filipino, Molave; T., Molauin, Lanahan; V., Aguherao, Bongabon, Bulaon, Hamoraun, Mauraun, Tugas, Tuigan, Agubarao; Il., Amugauan, Danigga, Sagad, Sagat; B., Amoraun, Hamuraon; Pamp., Bulaun, Bulauen; Neg., Yangal; Cag. and Isa., Amuganan; Surigao, Amuyaon (boards), Buyog-tongon (construction), Tugao.

Remarks.—*Vitex littoralis* Decne. is the principal species from which Molave is obtained, though how much of the wood on the market comes from a closely related species, *Vitex pubescens* Vahl., is not known. (See "Sasalit.")

YACAL.

Structural qualities.—The wood of Yacal is heavy, hard, strong, elastic, and quite durable. It breaks in long splinters.

Appearance, color, and grain.—Yacal has a dirty yellow color and is rather coarse but straight grained.

Uses.—Yacal is used in general construction and in shipbuilding, and is particularly valuable for beams, on account of its stiffness and high modulus of rupture.

Provinces leading in production.—Tayabas, Misamis, Surigao, and Cagayan.

Sizes.—There is a reported maximum diameter of 33 inches (84 centimeters) and a maximum clear length of 52 feet (16 meters) for Yacal from Tayabas. The tree attains sizes considerably larger than this in other provinces. One tree was measured at Santa Maria, Zamboanga, that had a diameter of 48 inches (122 centimeters).

Common names.—T., Yacal, Dilao, Yacal puti, Papolongan, Saplungan; Il., Taggay, Pangi, Banutan, Seggay, Paniggayen, Callot, Sallapugud; V., Linap; Pamp., Siacal; N. V., Banutan.

Remarks.—The wood of Yacal is obtained from *Hopea plagata* Vid. While it is very probable that other species are placed on the market as Yacal, yet it is not positively known what these species are.

NARRA.

Structural qualities.—The wood of Narra is moderately heavy, moderately hard, very durable, and is seldom, if ever, attacked by the anay (white ant). It seasons well when properly treated and takes a fine finish.

Appearance, color, and grain.—The heartwood of Narra is white, yellow, or red, and the sapwood nearly white. The grain is rather fine, but irregular, and very beautiful when quarter-sawn.

Uses.—Narra is used principally for fine furniture, cabinetmaking, and interior house trim.

Provinces leading in production.—Cagayan, Mindoro, Tayabas, Albay, Isabela, and Sorsogon.

Sizes.—On a coastal plain in Mindoro the average diameter of 137 trees 16 inches (40 centimeters) and over of Narra (*Pterocarpus indicus* Willd.) is 29 inches (74 centimeters). In a similar habitat in Baler, Tayabas, the average diameter of all Narra trees 8 inches (20 centimeters) and over, on 31 acres, is 25 inches (63 centimeters), the maximum diameter is 50 inches (127 centimeters), and the average clear length is 25 feet (7.6 meters). In southern Tayaba Narra has a recorded maximum diameter of 40 inches (101 centimeters) and a maximum clear length of 40 feet (12.2 meters).

Common names.—T., Narra, Asana; Pamp., Asana, Apalit, Daitanag; Cag., Tagga, Antangan, Taygat; Isa., Tagga, Antagan, Dungon (Calingan Igorot); B., Naga; V., Sangque, Narra; Il., Sangque, Magalayao.

Remarks.—There are two well-known species of Narra, *Pterocarpus indicus* Willd. and *P. echinatus* Pers. Botanically there are a number of other species, but little, if any, wood on the market comes from these.

Narra is divided commercially into two varieties, called Red and Yellow. So far as is known this division is not a specific one, but a difference due to the habitat in which the tree grows. Both species, *Pterocarpus indicus* and *P. echinatus*, have the red and yellow varieties. The red grows in the hilly country, near the streams generally, and the yellow is found in the flats near the seacoast.

Slabs are obtained from the buttresses of Narra, from which large one-piece table tops are made. These are sometimes 6 feet and over in diameter. Narra wood is often finished in its natural color and sometimes stained brown or dark red.

TANGUILE.

Structural qualities.—Tanguile is a light, moderately hard structural timber that varies considerably in quality. It is not durable in the ground or when exposed to the sun and rain. The heartwood of Tanguile is frequently unsound.

Appearance, color, and grain.—Tanguile is light reddish brown in color and is rather coarse grained.

Uses.—The wood is used in light and medium grade construction and is highly prized for small boats.

Provinces leading in production.—Surigao, Bataan, Cagayan, Cebu, Tayabas, and Bohol.

Sizes.—See "Balacbacan" for size.

Common names.—T., Tanguile, Tanguili, Panonsongin, Tangile, Tangili; V., Balacbacan, Babanganon; Il., Bunga, Tamug, Araca; B., Adamuy.

Remarks.—*Shorea polysperma* Merr. is the botanical name of Tanguile. There is very little doubt that a portion of the lumber that is put on the market as Balacbacan (see p. 644) is Tanguile.

SACAT.

Structural qualities.—Sacat is a moderately heavy and moderately hard wood. It is not very durable in the ground or when exposed to sun and rain.

Appearance, color, and grain.—Sacat is yellow and gray in color, and is coarse but straight grained.

Uses.—Sacat is used in light construction.

Provinces leading in production.—Pangasinan, Tarlac, Bulacan, and Pampanga.

Common names.—T., Sacat, Pangsaquet; Il., Saquet.

Remarks.—The tree that yields the wood Sacat is *Terminalia nitens* Presl. *Terminalia edulus* Blanco (Calumpit) yields a wood very much like Sacat.

IPIL.

Structural qualities.—Ipil is moderately heavy to heavy, hard, strong, almost impervious to decay, and is seldom, if ever, attacked by the anay (white ant).

Appearance, color, and grain.—Ipil is light yellow to dark brown in color. The grain is usually straight. It takes a beautiful dark-brown finish.

Uses.—Ipil is used for general first-class construction, especially posts of houses; for sleepers, and for furniture and cabinetmaking. Sleepers made of this wood have been buried for more than ten years without showing any signs of decay; consequently, it is highly valued for railroad ties.

Provinces leading in production.—Palawan, Cagayan, Mindoro, Masbate, and Ambos Camarines.

Sizes.—On a coastal plain in Palawan the average diameter of 60 trees 18 inches (45 centimeters) and over for *Intsia bijuga* is 24 inches (61 centimeters), and the average clear length of 20 trees is 29 feet (9 meters).

Common names.—T., Ipil, Camantatali (Laguna), Taal; Il., Sangay; V., Ipil; Guam, Ipil; Samoa, Ifi-lele; Pang., Obien, Ubien; Z., Nala.

Remarks.—The principal species that yield the timber Ipil is *Intsia bijuga* O. Kuntze. *Intsia acuminata* Merr., however, furnishes some of the wood, and the Ipil of Mindanao comes from a third unidentified species.

DUNGON.

Structural qualities.—Dungon is moderately heavy to heavy, strong, tough, durable, and very hard. It is difficult to work, is inclined to warp, and heart checks are numerous

Appearance, color, and grain.—Dungon has a chocolate-brown color and a fine, close grain.

Uses.—Dungon is used in first-class construction where strength and durability are essential, in naval construction, and as piles and posts. It is also valued in construction where bending by steaming is necessary, as for boat ribs.

Provinces leading in production.—Ambos Camarines, Zambales, Abra, Nueva Viscaya, Negros Occidental, and Masbate.

Sizes.—There is a recorded maximum diameter of 34 inches (86 centimeters) and a clear length of 47 feet (14.3 meters) for Dungon found in Tayabas Province.

Common names.—T., Dungon, Dongon, Dungol; Il., Paronapin, Palogapig; Z., Palonapim, Palonapoy.

Remarks.—The tree that yields Dungon is *Tarrietia sylvatica* Merr. This should not be confused with the wood known as Dungon-late (*Heritiera littoralis* Dry.), which grows near the upper limits of high tide. The Dungon of Mindanao is evidently another (unknown) species. (See tests in Tables I, II, and III.)

MALASANTOL.

Structural qualities.—Malasantol is a moderately heavy structural timber. It is moderately hard and fairly durable.

Appearance, color, and grain.—Malasantol is reddish brown in color, and straight but coarse grained.

Uses.—Malasantol is used in general construction.

Provinces leading in production.—Leyte, Pampanga, Pangasinan, and Bulacan.

Common names.—T., Malasantol; Il., Panantalen.

Remarks.—*Sandoricum vidalii* Merr. is the only tree that is known to yield the wood Malasantol.

SUPA.

Structural qualities.—Supa is a good structural timber, being heavy, hard, strong, and fairly durable. It is easily worked and seasons well.

Appearance, color, and grain.—Supa is yellow and brown in color and is fine grained.

Uses.—Supa is used in general construction, in flooring, in interior house trim, and for furniture and cabinetmaking.

Provinces leading in production.—Tayabas, Ambos Camarines, Union, Sorsogon, and Ilocos Sur.

Sizes.—Near Baler, Tayabas, the average diameter of all trees 8 inches (20 centimeters) and over, on 81 acres, is 15 inches (38 centimeters), the maximum diameter is 38 inches (97 centimeters), and the clear length is 40 feet (12.2 meters) for Manapo (*Sindora supa* Merr.).

Common names.—T., Malipáho, Supa, Yacal-diláo; B., Manápo; Cag., Paimo, Panalalián, Pancalían.

Remarks.—The only species that is known to yield the timber called Supa is *Sindora supa* Merr.

BALACAT.

Structural qualities.—Balacat is a moderately heavy, soft, inferior wood, which is not durable when exposed.

Appearance, color, and grain.—This wood is white to light brown in color, and is coarse grained.

Uses.—Balacat is used in light or temporary construction.

Provinces leading in production.—Tarlac and Bulacan.

Common names.—T., Ligaa; Pamp., Balacat.

Remarks.—*Zizyphus zonulatus* Blanco is the only species that is known to yield the timber known as Balacat. Very little of it is now being used.

MACAASIN.

Structural qualities.—Macaasin is a good structural timber, being moderately heavy, hard, strong, and fairly durable. It seasons well.

Appearance, color, and grain.—Macaasin is brown in color and rather fine grained.

Uses.—Macaasin is used in general construction; as flooring, joists, and rafters of houses, and in cabinetwork.

Provinces leading in production.—Tayabas, Ambos Camarines, Sorsogon, Laguna, and Leyte.

Common names.—T., Macaasin, Macasin, Macasim; B., Binolo; V., Saguimsimlumbajon, Batuan.

Remarks.—A number of species of *Eugenia* yield the wood known as Macaasin.

CALANTAS.

Structural qualities.—Calantas is moderately heavy, very soft, and not very strong, but is quite durable. It is easy to work and takes a good polish. It seasons well and is not inclined to shrink, warp, or check.

Appearance, color, and grain.—Calantas has a reddish color and is fine grained.

Uses.—Calantas is highly valued for cigar boxes. It is also used for small boats; in furniture, cabinet and pattern making, and for carving.

Provinces leading in production.—Mindoro, Ambos Camarines, Misamis, and Pangasinan.

Sizes.—In Mindoro a recorded maximum diameter of 90 inches (228 centimeters) and a total height of 180 feet (55 meters) is given for Calantas. Few trees are found, however, that have a diameter of more than 60 inches (152 centimeters). The boles are usually straight and cylindrical.

Common names.—T., Calantas; V., Lanigpa, Lanigda, Lanipga; B., Lanigpa, Lanigda; Il., Catingin, Danipra, Porac; Pamp., Calantad.

Remarks.—The specific name (or names) of the tree that produces the wood known as Calantas is not known. It is, however, known that one or more species of the genus *Toona* (*Cedrela*) yields this wood. The wood somewhat resembles the Red Cedar (*Juniperus*) in color and odor. It is closed to the West Indian *Cedrela odorata* L., the East Indian *Cedrela toona* Roxb., and the Australian *Cedrela australis*, both botanically and in the structure and quality of the wood. The general name of Red Cedar is applied to all species of Cedrela. They are known in India under the general name of "Toon."

TINDALO.

Structural qualities.—The wood of Tindalo is heavy, hard, stiff, strong, and durable above ground. It is prized for beams because of its high modulus of rupture. It seasons well and breaks in long splinters.

Appearance, color, and grain.—Tindalo is yellowish red in color. It is fine and usually straight grained, but occasional pieces are found having the appearance of bird's-eye maple. It takes a beautiful finish.

Uses.—Tindalo is highly valued for fine furniture and cabinetmaking. It is also used for construction purposes above ground.

Provinces leading in production.—Masbate, Negros Occidental, Iloilo, Ambos Camarines, Rizal, and Pangasinan.

Sizes.—In Baler, Tayabas, the average diameter of all trees of *Pahudia rhomboidea* Prain 8 inches (20 centimeters) and over, on 81 acres, is 12 inches (30 centimeters) and the maximum diameter is 24 inches (61 centimeters). The tree attains much larger sizes in other provinces.

Common names.—T., Tindalo, Balayong, Tindolo; Cag., Magalayao; Il., Magalayao, Uris; B., Barayon, Balayon, Baraya, Balayong; V., Barnion, Balayon, Barion, Balaon, Barayon; Pang., Ipel.

Remarks.—*Pahudia rhomboidea* Prain (*Afzelia rhomboidea* Vid.) yields the wood known as Tindalo.

AMUGUIS.

Structural qualities.—Amuguis is a structural wood of medium quality, being fairly strong, brittle, moderately heavy and hard.

Appearance, color, and grain.—Amuguis is reddish brown in color and is rather fine grained.

Uses.—Amuguis is used in ordinary construction and in cabinetwork.

Provinces leading in production.—Ambos Camarines, Mindoro, Albay, Tayabas, Tarlac, and Masbate.

Sizes.—On a coastal plain in Mindoro the average diameter of 185 trees of *Koordersiodendron pinnatum* Merr. 16 inches (40 centimeters) and over is 25 inches (63 centimeters), and the average clear length of 10 trees is 33 feet (10 meters). In Baler, Tayabas, the average diameter of all trees of Amuguis, on 81 acres, 8 inches (20 centimeters) and over is 13 inches (33 centimeters) and the maximum diameter is 31 inches (79 centimeters.)

Common names.—T., Amuguis, Amoguis, Ambogues, Palosanto; V., Danguila, Sambaluyan, Amoguis, Ambogues, Muguis, Sambulauan, Calumanog; Il., Bancalari; B., Carugcog; Neg., Twi.

Remarks.—*Koordersiodendron pinnatum* Merr. is the only species that yields the wood Amuguis.

ACLE.

Structural qualities.—The wood of Acle is moderately heavy and hard, quite durable, and seasons well.

Appearance, color, and grain.—This is one of the most beautiful Philippine woods. It has a rich dark-brown color and is fine grained. It resembles English walnut and is usually given a walnut finish. When plain sawn it presents a large irregular figure, but when quarter sawn the grain appears finer.

Uses.—Acle is highly valued for fine furniture and cabinetmaking. Plain sawn lumber is preferable for large surfaces and quarter sawn for small surfaces and panels. This wood is considered as good as walnut for gunstocks, but has not yet been used commercially for that purpose.

Provinces leading in production.—Masbate, Zambales, Tayabas, Union, Cagayan, and Pangasinan.

Sizes.—Acle is a tree with a short irregular bole.

Common names.—T., Acle; Il., Anaguep, Quitaquita; V., Tabalangi, Langit.

Remarks.—*Pithecolobium acle* Vid. is the only tree that yields the wood known as Acle.

BETIS.

Structural qualities.—Betis is a high grade structural timber, being very hard, heavy, strong, and durable. It lasts well in the ground and is fairly resistant against the attack of sea worms (teredo).

Appearance, color, and grain.—Betis is a light brown to purplish color and is very fine grained.

Uses.—Betis is used in general high-grade construction, where strength and durability are essential. It is used in shipbuilding and for piles and posts.

Provinces leading in production.—Leyte, Ambos Camarines, Tayabas, Isabela, and Cagayan.

Common names.—T., Betis, Pailan, Bayacao, Betes, Bétis laláque, Bitis; Cag., Pagpagan, Pailan, Pappagay; Pang., Bacayao; B., Baniti; V., Banicac; Il., Bacayao.

Remarks.—*Illipe betis* Merr. is the only tree that is known to yield the wood Betis.

BANSALAGUIN.

Structural qualities.—Bansalaguin is a valuable structural timber, being very hard heavy, strong, brittle, and durable. Large sizes of it check somewhat in seasoning, and it is hard to saw.

Appearance, color, and grain.—Bansalaguin has a dull reddish color and is very fine grained.

Uses.—Bansalaguin is a first-class construction timber and is used for posts, for shipbuilding, as tool handles, and in turnery.

Provinces leading in production.—Tayabas, Ilocos Sur, Pangasinan, Cagayan, Abra, and Masbate.

Common names.—T., Bansaláguin, Bansalágin, Bansalágon, Bansalágue, Cabiqui, Pasac; V., Bansalague, Bansalogue, Talipópo; Z., Pasac; B., Bansalagui.

Remarks.—*Mimusops elengi* L. is the only tree that is known to yield the wood Bansalaguin.

PALO MARIA.

Structural qualities.—Palo Maria is a good construction timber; is hard, moderately heavy, and fairly strong and durable. It is inclined to warp slightly.

Appearance, color, and grain.—Palo Maria has a reddish color, is fine grained, and takes a beautiful finish. It has an irregular figure, which is caused by part of the fibers running perpendicular to the surface.

Uses.—Palo Maria is used in general construction, for masts, and for hubs and turnery. It is very valuable for fine furniture.

Provinces leading in production.—Ilocos Sur, Ilocos Norte, Isabela, Pangasinan, and Mindoro.

Common names.—Palo Maria de la Playa: T., Bitanhol, Bancalan, Dancalan, Dingcalin, Palo Maria, Palo Maria de la Playa, Tamauian; Il., Bitog, Bitaog, Pamitaoguen, Pamitlaten, Bitaosy, Biroy, Vitog, Bansangal, Pamitlain, Pamitclaten, Sarumayer; Z., Bitoc, Birog, Bitaoi; Cag., Dancalan; V., Bitaog, Dancalan, Bitanghol, Pamitaogon, Bitaob; Pamp., Bitaog, Palo Maria, Bitaob; B., Dancalan. Palo Maria del Monte: T., Batinan-amo.

Remarks.—There are two species, used indiscriminately, that produce the wood known as Palo Maria, and which resemble each other very closely. *Calophyllum inophyllum* L. is known as Palo Maria de la Playa and grows only on the seacoast. *Calophyllum wallichianum* Pl. et Tr., found inland, is known as Palo Maria del Monte. The latter has a straighter grain and is not so beautiful as the former in finished work. Palo Maria del Monte, however, is more easily polished.

BATITINAN.

Structural qualities.—Bitatinan is a structural timber of good quality, being hard, durable, and heavy.

Appearance, color, and grain.—Batitinan is light yellow to olive green in color and has a fine and straight grain.

Uses.—Batitinan is used in general construction and for posts and sleepers.

Provinces leading in production.—Tayabas, Ilocos Sur, Ambos Camarines, Rizal, and Misamis.

Common names.—T., Batitinan; B., Tinaan; Il., Magatululung, Lasila, Bingas; V., Miao, Saguimsim; Pamp., Batitian; Pang., Baticalag; province unknown, Nathubo, Lumate, Bugaron, Mañglate.

Remarks.—The only species known to yield the timber called Batitinan is *Lagerstrœmia batitinan* Vid.

ARANGA.

Structural qualities.—Aranga is very hard, heavy, strong, and durable. It is one of the most valuable woods in sea water, for it withstands well the action of the sea worm (teredo). It is usually clear and sound, and seasons without difficulty.

Appearance, color, and grain.—Aranga is light yellow in color and fine grained.

Uses.—Aranga is used as piling and in construction in sea water almost exclusively. It is, however, a very valuable timber for high grade construction.

Provinces leading in production.—Ambos Camarines and Tayabas.

Common names.—T., Aranga, Arangan; V., Arang, Puyot, Ampupuyot; Il., Arangin, Cuela.

Remarks.—*Homalium luzoniense* F. Vill., *H. panayanum* F. Vill., and *H. villarianum* Vid. are the three species that probably yield the timber known as Aranga. *H. panayanum* is known among the Visayans as Puyot.

BANUYO.

Structural qualities.—Banuyo is moderately heavy and moderately hard, but is not very strong. It is easily worked.

Appearance, color, and grain.—The wood of Banuyo is golden brown in color and has a fine grain, similar to that of Acle. It is often finished in its natural color and sometimes stained a dark brown and given an Acle finish.

Uses.—Banuyo is used in making fine furniture and in cabinetwork. Its beauty is only beginning to be appreciated. It is used to some extent in light construction.

Provinces leading in production.—Masbate, Negros Occidental, and Ambos Camarines.

Common name.—T., Banuyo.

Remarks.—The scientific name of the tree that yields the wood known as Banuyo is not known.

BALACBACAN.

Structural qualities.—Balacbacan is moderately heavy, very soft, and brittle. It seasons well and is easily worked.

Appearance, color, and grain.—Balacbacan is reddish brown in color and coarse grained.

Uses.—Balacbacan is used in light or temporary construction and for inferior cabinetwork.

Province leading in production.—Negros Occidental.

Sizes.—In the island of Negros the average diameter of 620 trees 16 inches (40 centimeters) and over is 27 inches (69 centimeters), and the average merchantable length of 6 trees is 69 feet (21 meters) for Balacbacan or Tanguile (*Shorea polysperma* Merr.). In the same stand, for the tree known as Mangachapuy (see below) measurement of 1,142 trees 16 inches (40 centimeters) and over shows the average diameter to be 34 inches (86 centimeters), and the merchantable length (average of 23 trees) is 72 feet (22 meters).

Common names.—T., Tanguile, Panonsongin, Tangili, Tanguili, Tangile; Il., Bunga, Tamug, Araca; V., Balacbacan, Mangachapuy, Babanganon; B., Adamuy.

Remarks.—The wood that is sold on the market for Balacbacan comes from two species of *Shorea*. A small portion of it comes from *Shorea polysperma* Merr., and is known by the Visayan name of Balacbacan. The larger portion of it, however, comes from a tree known by the Visayans as Mangachapuy, which is an unidentified species of *Shorea*. Both woods have also the common name of Tanguile (see p. 640) and Red Lauan.

MAYAPIS.

Structural qualities.—Mayapis is a light, soft wood and is not durable.

Appearance, color, and grain.—Mayapis is white and gray in color and coarse grained.

Uses.—Mayapis is used in light or temporary construction.

Provinces leading in production.—Laguna, Tayabas, Bataan, and Cagayan.

Sizes.—In Baler, Tayabas, measurements of all trees 8 inches (20 centimeters) and over in diameter, on 31 acres, show that Mayapis has an average diameter of 26 inches

(66 centimeters), a maximum diameter of 75 inches (190 centimeters), and an average merchantable length of 68 feet (21 meters).

Common name.—T., Mayapis.

Remarks.—The tree that yields most of the lumber known as Mayapis is probably *Anisoptera vidaliana* Brandis, though other species of *Anisoptera* and some species of *Shorea* are known as Mayapis.

MALUGAY.

Structural qualities.—The most important property of Malugay is toughness, a quality quite uncommon among Philippine woods. It bends well when steamed, is fairly strong and stiff, and has long fibers. It is moderately heavy and moderately hard, but easily worked. It is usually free from defects and shrinks considerably while seasoning, but does not check badly.

Appearance, color, and grain.—Malugay ranges in color from reddish to white and is fine grained.

Uses.—Malugay is used for ribs and planking for small boats; in interior trim; for cabinetwork, and for general construction.

Provinces leading in production.—Malugay is abundant in Mindoro but is not marketed from other parts of the Archipelago..

Common name.—T., Malugay.

Remarks.—This wood has only recently been introduced into the Manila market and at present is not used extensively. It is an excellent wood in many respects and will undoubtedly come into greater favor. The scientific name of the tree that yields Malugay is not as yet known. From imperfect botanical material it is known to be a member of the *Anacardiaceæ*, and probably belongs to the genus *Dracontomelum.*

SASALIT.

Structural qualities.—Sasalit is a very hard, heavy, close-grained, and durable wood. Small knots and checks are quite common.

Appearance, color, and grain.—It has the color of Molave—that is, a pale-yellow color—and is fine grained.

Uses.—Sasalit is used for posts, general house construction, and is considered as good as Molave for these purposes.

Provinces leading in production.—Zambales, Bataan, and Negros Occidental.

Sizes.—In the island of Negros the average diameter of 173 trees 12 inches (30 centimeters) and over of Dungula (*Vitex aherniana* Merr.) is 15 inches (37 centimeters). In Baler, Tayabas, the average of all trees of Igang (*Vitex aherniana*) 8 inches (20 centimeters) and over, on 81 acres, is 12 inches (30 centimeters), the maximum diameter is 38 inches (96 centimeters), and the clear length is 33 feet (10 meters).

Common names.—Z., Sasalit; Baler, Tayabas, Igang; V., Dungula.

Remarks.—The tree that yields the timber known as Sasalit is *Vitex aherniana* Merr. It is a wood very similar to Molave in quality, but trees of it do not reach very large dimensions.

LIUSIN.

Structural qualities.—Liusin is a very hard, heavy, strong, and durable wood. It withstands well the action of the sea worm (teredo).

Appearance, color, and grain.—Liusin is white and reddish in color, and is fine grained.

Uses.—Liusin is used in piling, for wharf construction, and for shipbuilding. It is considered one of the best woods for construction exposed to sea water.

Provinces leading in production.—Bataan and Zambales.

Common names.—T., Liusin; V., Sampinit.

Remarks.—The only tree that is known to yield Liusin is *Parinarium griffithianum* Benth.

LUMBAYAO.

Structural qualities.—Lumbayao is a soft and moderately heavy wood of medium quality. It seasons well and is usually free from defects.

Appearance, color, and grain.—Lumbayao has a reddish-brown color and is coarse grained.

Uses.—Lumbayao is used in general construction.

Province leading in production.—Moro.

Remarks.—This wood is marketed in Zamboanga, Iloilo, and Cebu, but is not brought to Manila. The scientific name of the tree that yields the wood is unknown.

TABLE IV.—*Summary of mechanical tests on thirty-two species of American woods.*

[From Tables I, II, IV, V, and VI, Circular No. 15, Division of Forestry, United States Department of Agriculture.]

Kind of wood.	Specific gravity of dry wood.	Fiber stress at relative (apparent) elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Stress at rupture compression along the grain (pounds per square inch).	Stress at rupture shearing along the grain; not reduced for moisture (pounds per square inch).
Reduced to 15 per cent moisture.						
Longleaf Pine	0.61	8,500	10,900	1,890	6,900	700
Cuban Pine	.63	9,500	11,900	2,300	7,900	700
Shortleaf Pine	.51	7,200	9,200	1,600	5,900	700
Loblolly Pine	.53	8,200	10,100	1,950	6,500	700
Reduced to 12 per cent moisture.						
White Pine	.38	6,400	7,900	1,390	5,400	400
Red Pine	.50	7,700	9,100	1,620	6,700	500
Spruce Pine	.44	8,400	10,000	1,640	7,300	800
Bald Cypress	.46	6,600	7,900	1,290	6,000	500
White Cedar	.37	5,800	6,300	910	5,200	400
Douglas Spruce[a] (Oregon Pine)	.51	6,400	7,900	1,680	5,700	500
White Oak	.80	9,600	13,100	2,090	8,500	1,000
Overcup Oak	.74	7,500	11,300	1,620	7,300	1,000
Post Oak	.80	8,400	12,300	2,030	7,100	1,100
Cow Oak	.74	7,600	11,500	1,610	7,400	900
Red Oak	.73	9,200	11,400	1,970	7,200	1,100
Texan Oak	.73	9,400	13,100	1,860	8,100	900
Yellow Oak	.72	8,100	10,800	1,740	7,300	1,100
Water Oak	.73	8,800	12,400	2,000	7,800	1,100
Willow Oak	.72	7,400	10,400	1,750	7,200	900
Spanish Oak	.73	8,600	12,000	1,930	7,700	900
Shagbark Hickory	.81	11,200	16,000	2,390	9,500	1,100
Mockernut Hickory	.85	11,700	15,200	2,320	10,100	1,100
Water Hickory	.73	9,800	12,500	2,080	8,400	1,000
Bitternut Hickory	.77	11,100	15,000	2,280	9,600	1,000
Nutmeg Hickory	.78	9,300	12,500	1,940	8,800	1,100
Pecan Hickory	.78	11,500	15,300	2,530	9,100	1,200
Pignut Hickory	.89	12,600	18,700	2,730	10,900	1,200
White Elm	.54	7,300	10,300	1,540	6,500	800
Cedar Elm	.74	8,000	13,500	1,700	8,000	1,300
White Ash	.62	7,900	10,800	1,640	7,200	1,100
Green Ash	.62	8,900	11,600	2,050	8,000	1,000
Sweet Gum	.59	7,800	9,500	1,700	7,100	800

[a] Actual tests on "dry" material not reduced for moisture.

TABLE V.—*Results of tests on thirteen Borneo woods.*

Kind of wood.	Number of beams tested.	Average per cent of moisture.	Average specific gravity of dry wood.	Average fiber stress at apparent elastic limit (pounds per square inch).	Average modulus of rupture (pounds per square inch).	Average modulus of elasticity (1,000 pounds per square inch).	Average stress at rupture compression along grain (pounds per square inch).	Average stress at rupture shearing along grain (pounds per square inch).
Selangan Batu (Borneo Yacal)	4	27.6	0.689	9,595	12,325	2,027	7,420	755
Penagah	4	11.6	.594	7,880	8,860	1,140	6,020	880
Merabau (Borneo Ipil)	3	21	.965	14,000	18,830	2,505	9,035	1,030
Camphor	4	21.2	.61	8,455	11,490	1,900	6,540	557
Billian (Ironwood)	4	22.5	.96	16,500	19,660	2,384	11,290	895
Kruen	4	22.7	.542	5,985	8,700	1,604	4,840	653
Seraiah Mira (Borneo Cedar)	4	16.2	.507	5,650	7,450	1,299	4,920	614
Seraiah Puteh	4	28.1	.493	6,600	9,390	1,554	5,195	547
Selangan Kacha	4	27.4	.563	8,090	11,040	1,731	6,530	612
Oba Suluk	3	18.1	.582	6,620	9,780	1,283	5,270	840
Rungus (Borneo Rosewood)	1	28.6	.55	7,700	8,700	1,890	5,555	633
Gagil	2	31.6	.43	5,875	8,070	1,385	4,960	715
Griting (Borneo Oak)	4	25.7	.706	9,280	11,860	1,586	7,590	906

NOTE.—All beams were clear and sound.

TABLE VI.—*Comparison of selected Philippine, Borneo, and American woods.*

Name.	Locality.	Compression, along the grain.		Cross-bending.			
		Average per cent moisture.	Average stress at rupture (pounds per square inch).	Average per cent moisture.	Average modulus of rupture (pounds per square inch).	Average modulus of elasticity (1,000 pounds per square inch).	Average specific gravity of dry wood.
Aranga	Philippine Islands	4.9	12,420	5.6	17,920	2,419	0.859
Billian (Borneo Ironwood).	Borneo	22.5	11,290	22.5	19,660	2,384	.96
Pignut Hickory	United States	12	10,900	12	18,700	2,730	.78
Dungon	Philippine Islands	10.7	9,420	11.6	17,110	2,209	.857
Yacal	do	13.4	9,220	15.6	15,690	2,583	.843
Merabau (Borneo Ipil)	Borneo	21	9,035	21	18,830	2,505	.965
White Oak	United States	12	8,500	12	13,100	2,090	.80
Molave	Philippine Islands	12.7	8,330	10.4	8,580	1,614	.785
Guijo	do	14.6	7,940	13.7	15,150	2,158	.708
Selangan Batu (Borneo Yacal).	Borneo	27.6	7,420	27.6	12,325	2,027	.689
Apitong	Philippine Islands	14.4	7,250	14	11,620	2,144	.645
Longleaf Pine	United States	15	6,900	15	10,900	1,890	.61
Ipil	Philippine Islands	17.7	6,570	18.1	6,980	1,383	.792
Lauan	do	12.4	6,180	10.4	9,760	1,653	.446
Oregon Pine	United States	12	5,700	12	7,900	1,680	.51
California Redwood	do	13.3	5,560	12.3	9,110	1,320	445

PART II.

PHILIPPINE SAWMILLS, LUMBER MARKET, AND PRICES.

Manila is the principal lumber market of the Philippine Islands. Here are located five of the most important mills. Timber is being shipped to them from all parts of the islands. Three of these mills are equipped with heavy band saws and other modern machinery. The other mills are equipped with vertical gang and circular saws. The combined sawing capacity of the five mills is about 100,000 board-feet per day. One mill has a capacity of 30,000 board-feet, two of 20,000 board-feet, and two of 15,000 board-feet per day.

During the early operations of the mills in Manila they had to contend with numerous difficulties; Filipino labor was unreliable; many of the hard woods were difficult to saw, and it was impossible to secure a sufficient supply of logs from the provinces with regularity. Conditions have improved, however, during the past two years, and the mills are now operating in a very satisfactory manner. They now saw all commercial woods without difficulty, and are depending more and more upon their own cuttings to supply logs to meet their requirements. With proper training, Filipinos are found to be apt in handling machinery. Two of the mills have recently been running at night to fill orders.

Some confusion exists in the market regarding the identity of a few of the leading commercial woods. This is especially true of Lauan. At least six different woods are now being marketed under that name. From the commercial standpoint this is not important, however, as all of these woods resemble the true Lauan (*Shorea contorta*) closely and are of about the same quality. There are several different kinds of wood being sold for Apitong, and occasionally Apitong is sold for Guijo. Lauan, Apitong, and Guijo are used to a larger extent than any other fifteen native woods.

Logs are bought and sold by the Spanish cubic foot. One Spanish cubic foot equals 0.765 of an English cubic foot. Lumber is bought and sold by the thousand English board-feet.

In sawing the average-sized logs that are brought into the market, between 5 and 6½ board-feet are obtained from 1 Spanish cubic foot, but in the large-sized logs sometimes as high as 8 board-feet are cut from 1 Spanish cubic foot.

Until quite recently it has been practically impossible to obtain well-seasoned lumber in the market. The mills have been accustomed to sawing to order; consequently lumber was seldom in the yards a sufficient length of time to become seasoned. There were no facilities for kiln drying lumber in large quantities. Two small kilns were erected several years ago, but they were of small capacity and have not been used extensively. One of the leading mills has recently installed a kiln of about 50,000 board-feet capacity, which is operating very satisfactorily. This kiln is capable of drying 100,000 board-feet or more of native lumber per month, the amount depending upon the texture and thickness of the lumber. This concern is now using kiln-dried native lumber in its cabinet factory and is preparing to kiln dry Oregon Pine and Califronia Redwood for use in its planing mill.

A considerable amount of imported lumber is still used in the islands. Most of this is Oregon Pine and California Redwood. During the period from July 1, 1904, to June 30, 1905, 29,679,644 board-feet of lumber and timber, and 9,261 pieces of timber (dimensions not known) were imported. During the same period 139,148.77 cubic meters of native timber were cut. If this were all sawn into lumber it would make about 40,000,000 board-feet.

The price of logs fluctuates from day to day. The following table gives the Manila market prices on August 1, 1906.

Manila market prices.

[Philippine currency.]

Kind of wood.	Logs per Spanish cubic foot.	Sawing per 1,000 English board-feet.	Lumber per 1,000 English board-feet.
Lauan	₱0.30-0.35	₱13.00-15.00	₱70.00- 90.00
Apitong	.35- .37	16.00-18.00	90.00-115.00
Guijo	.50- .65	16.00-18.00	98.00-140.00
Molave	.80- .90	21.00-23.00	215.00-300.00
Yacal	.65-1.00	21.00-23.00	160.00-200.00
Yellow Narra	.70- .80	16.00-23.00	225.00-275.00
Red Narra	.75-1.00	16.00-23.00	250.00-300.00
Tanguile	.33- .45	13.00-18.00	95.00-120.00
Sacat	.40- .75	15.00-18.00	100.00-150.00
Ipil	.76- .85	21.00-23.00	180.00-225.00
Dungon	.80- .90	38.00-40.00	220.00-300.00
Supa	.65- .70	21.00-23.00	140.00-220.00
Balacat	.40	18.00	100.00
Macaasin	.40- .75	15.00-18.00	110.00-150.00
Calantas	.65-1.20	13.00-15.00	180.00-200.00
Tindalo	.78-1.00	21.00-23.00	250.00-300.00
Amuguis	.40- .75	18.00-21.00	110.00-150.00
Acle	.85-1.20	16.00-23.00	280.00-350.00
Betis	.70-1.00	38.00-40.00	250.00-300.00
Bansalaguin	.45- .85	23.00	150.00-260.00
Palo Maria	.75- .80	18.00	175.00-185.00
Batitinan	.65- .75	21.00-23.00	150.00-280.00
Aranga	.50- .75	21.00-23.00	150.00-160.00
Banuyo	.55- 75	16.00-18.00	140.00-220.00
Malugay	.60- .65	16.00-23.00	95.00-130.00
Balacbacan	.35	13.00-18.00	70.00- 90.00
Mayapis	.35	15 00	90.00

The government stumpage charges in the provinces where large stands of timber are found range from $1 to $5 gold per 1,000 board-feet.

Aside from the logging which is carried on to supply the Manila mills, there is some logging in connection with mills located in the provinces.

The operations of one company in Negros Occidental are probably more extensive than those of any other company in the provinces. Their mill has a capacity of about 20,000 board feet per day, but the daily cut is less than 10,000 board feet. The trees known by the Visayan names of Balacbacan, Mangachapuy, and Almon are being cut principally; the first two are sold in Iloilo and Manila as Red Lauan or Balacbacan. Almon has the market name of White Lauan. This company has recently purchased a narrow-gauge railway for use in logging and contemplates putting in a new mill, with a much larger capacity, in the near future. Another company has a mill located on the island of Basilan, which is cutting about 6,000 board feet of lumber per day. This lumber is marketed in Zamboanga, Iloilo, and Cebu. The Zamboanga prices quoted by this company are as follows:

	Per 1,000 board-feet.
Lumbayao	₱72.00
Guijo	80.00
Calantas	80.00
Yacal	140.00
Camagon	300.00
Tindalo	180.00
Ipil	180.00
Lauan	50.00
Narra	200.00

Planing, ₱7 extra per 1,000 board-feet.

Another company, a branch of a Manila milling company, has recently installed in Mindoro a circular-saw mill, with a capacity of 5,000 to 10,000 board-feet per day. In the near future this company will have the mill operating at full capacity and will ship lumber to Manila.

Near Baguio, Benguet, there is a mill for sawing Benguet pine, which sells in Baguio and vicinity for ₱85 to ₱95 per 1,000 board-feet. The maximum capacity of the mill is 3,000 board-feet per day, and the average daily cut is 2,000 board-feet. In the near future this company will have a new sawmill in operation in the same locality.

A small mill has recently been installed at Gattaran, Cagayan, which supplies Aparri and the towns up the Cagayan River with lumber. This mill charges ₱0.80 per English cubic foot for first-group timber in the log, and ₱20 per 1,000 board-feet for sawing.

About 2,500 board-feet per day is the capacity of a mill which is cutting Agoho (*Casuarina equisetifolia* Forst.) almost exclusively at San Antonio, in the province of Tarlac. This is put on the market at Manila for ₱100 per 1,000 board-feet.

BUREAU OF FORESTRY.

(Bulletin No. 5.)

A PRELIMINARY WORKING PLAN FOR THE PUBLIC FOREST TRACT OF THE INSULAR LUMBER COMPANY, NEGROS OCCIDENTAL, P. I.[a]

By H. D. EVERETT, *forester, in charge of forest district No. 8*, and H. N. WHITFORD, Ph. D. *forester, chief of the division of forest products.*

LETTER OF TRANSMITTAL.

MANILA, *September 24, 1906.*

SIR: I have the honor to submit herewith a manuscript entitled "A Preliminary Working Plan for the Public Forest Tract of the Insular Lumber Company, Negros Occidental, P. I.," by H. D. Everett, forester, in charge of forest district No. 8, and H. N. Whitford, forester, chief of the division of forest products, and respectfully recommend its publication as Bulletin No. 5.

Very respectfully,

GEORGE P. AHERN,
Director of Forestry.

The SECRETARY OF THE INTERIOR, *Manila, P. I.*

INTRODUCTION.

The following working plan has been prepared:

First. To furnish a prescribed plan for the regulation and management of the large tract of public forest in the island of Negros granted to the Insular Lumber Company for a period of twenty years.

Second. To secure accurate information concerning the timber of an important forest region of the Philippine Islands.

Third. To give the native rangers employed in the bureau of forestry needed training in forest field work.

Field work was begun May 1, 1906, and completed June 15, 1906. Two foresters, one assistant forester, three native rangers, and a constantly changing force of six to fifteen laborers were engaged in the work. Owing to the short time available for the field work, some interesting information was not secured which would add to the completeness and detail of the report.

The field work divided itself into three parts: First, forest map; second, botanical survey; third, collection of data for forest management.

There were made 135 acres of valuation surveys of standing timber, 15 reproduction plots, volume measurements of 57 felled trees, measurement of area logged, valuation surveys in logged area, sylvicultural studies of the principal species, a study of the logging operation, collection of log specimens of the principal species, and a general botanical collection of trees and other plants growing on the tract.

Two base lines were run through the concession 8 kilometers long and 5 kilometers apart, with stations marked every one-half kilometer. Then from each kilometer station, valuation survey lines were run east and west of the base line. The trees 5 meters, or 1 rod, each side of these survey lines were calipered as nearly as possible at the point just above the main buttresses. In this manner about 29 per cent of the total area of the tract was surveyed with the actual measurement of the trees on 1 per cent of this area. The figures for stand of timber in the report are based on this measurement. Since the merchantable forest on the tract is remarkably uniform in composition and density, it is believed that the figures can be applied to the entire area of upland or merchantable forest. However, it is better to confine their application to the area lying between the Himugaan and Hitalon rivers, where the surveys were made.

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[a] The following illustrations accompanying this report have been omitted and are on file in the War Department:

Plate I. Cutting a large Almon tree. (Frontispiece.) II. Mangachapuy seedlings in the forest. III. Clearing on logged land. IV. Characteristic caiñgins under rude cultivation. V. Hauling engine at the landing. VI. Bridge on the hauling road. VII. Yarding engine at the end of the hauling road. VIII. Cutting up a large Mangachapuy tree. IX. Forest in good condition after logging. X. Forest in poor condition after logging. XI. General view of the sawmill site. XII. Sawmill of the Insular Lumber Company.

Map of the forest tract on the Himugaan River, Negros Occidental, P. I., operated under a twenty-year license agreement by the Insular Lumber Company.

This working plan is provisional only and should be revised as soon as complete data in regard to the tract is secured. It will serve as a guide for the next few years, while the Insular Lumber Company is initiating extensive operations. As much field work as possible should be done on the tract each year, with the revision of the plan in mind.

PART I.

STATEMENT OF THE FACTS UPON WHICH THE WORKING PLAN IS BASED.

GENERAL DESCRIPTION OF THE TRACT.

SITUATION AND AREA.

The tract of the Insular Lumber Company is situated in the municipalities of Cadiz and Sagay, province of Negros Occidental, island of Negros, P. I., approximately in latitude 10° 50′ north and longitude 123° 30′ east of Greenwich. Its area is 69 square miles, or 44,160 acres (18,000 hectares), of which approximately 39,660 acres (16,060 hectares) are forested and the remaining 4,500 acres cultivated, waste land, and recent clearings. The tract lies on the lower slopes of Mount Silay, just back of the coastal strip of sugar lands, here about 6 miles wide, and consists of two adjoining parts, the upper and smaller of which lies to the south of the lower along the Himugaan River. It is a part of the large and similar forest which extends from Escalante to Silay, some 50 miles, lying 6 to 15 miles back from the coast and extending far into the interior. In some places, as on the Himugaan River, it occupies rolling and hilly lands, and in others, as near Silay, it has been driven back to the steep foothills.

BOUNDARIES.

Lower tract.—Beginning at a point on the left bank of the Himugaan River, at the mouth of Lumbunao Creek, about 6 miles south of the coast line; thence the boundaries run east-southeast for about 6 miles to a point 1 mile due south of Baobao Hill; thence south-southwest 5 miles; thence west-northwest 12 miles; thence north-northeast 5 miles; thence east-southeast 6 miles to the starting point; in all, an area of 60 square miles.

Upper tract.—Beginning at a point on the southern boundary of the lower tract, 1½ miles east-southeast of the Himugaan River, the boundaries run south-southwest 3 miles; thence west-northwest 3 miles; thence north-northeast, 3 miles; thence east-southeast along the southern boundary of the lower tract to the starting point; in all, an area of 9 square miles.

The boundary lines are not marked in any way. They are bordered by dense forest on the east, south, and west, and by alternating patches of forest, waste land, and cultivated land on the north.

PHYSIOGRAPHY.

The land is characterized by gentle slopes, with alternating ridges at the base of Mount Silay. The elevation ranges from 100 feet at points on the northern boundary to 1,200 feet at the highest point on the southern boundary. Small streams and arroyos are scattered profusely over the tract.

Four large rivers drain the tract and small tributary streams are numerous. The Himugaan River, flowing in a deep, winding valley through the middle, drains about 65 per cent of the area. It is the largest of the four rivers and is navigable by small steamers as far as the company's sawmill, about 6 miles from its mouth. The Hitalon and Talabon rivers drain the extreme western and the Tanoa River the eastern parts of the tract.

SOIL AND UNDERLYING ROCK.

The rock and soil are practically uniform throughout the tract. The former is a black igneous rock, which rapidly disintegrates, forming a deep, stiff clay soil, brown in color. The soil is evidently fertile, as it yields good crops of corn and sugar cane where it is now under cultivation. The rock outcrops along the streams and frequently occurs as bowlders on the surface of the ground.

CLIMATE.

The climate of this region is tropical. Extreme heat, however, is moderated by the influence of the surrounding waters and by the cool sea breezes, which blow almost constantly. These are the northeast monsoon, which prevails from about June to November 1, and the southwest monsoon, from November 1 to June 1, with short periods of variable winds at the times when the monsoons change. The coolest time of year is from November to March, and the hottest from March to June. The following table gives the average monthly maximum and minimum temperatures for 1903 at Bacolod, Negros Occidental. They are probably slightly higher than they should be for the immediate neighborhood of the tract.

TABLE I.—*Temperature at Bacolod, Negros Occidental, 1903.*

Month.	Average monthly temperature.		Month.	Average monthly temperature.	
	Maximum.	Minimum.		Maximum.	Minimum.
	°*F.*	°*F.*		°*F.*	°*F.*
January	86	72.6	July	86.8	73.8
February	85.6	71.8	August	87.8	73.2
March	88.5	70.5	September	86.8	73.2
April	91.6	73	October	86.5	73.4
May	91.8	74.6	November	87	73.8
June	88.8	74.6	December	85	73.2

There are two general seasons, wet and dry. From January 15 to May 15 the weather is dry, although showers are often frequent during the latter part of January and the beginning of May. From May 15 to January 15 it is generally wet, with the greatest amount of rainfall in July, September, and October. The following table of monthly rainfall in Bacolod, Negros Occidental, and in Iloilo, Iloilo, is applicable in a general way to this tract, although it is important to remember that the northeast monsoon, bearing rain at the time most needed, strikes with more force on the north and northeast coast of Negros, where the tract is situated, than at Bacolod or Iloilo, and hence the dry season is probably considerably less pronounced than it is at Bacolod. The vegetation is, in consequence, much more luxuriant than in parts of the islands where the dry season is more extended. In the forest in question the trees are not without leaves at any time of the year. In other words, it is a typical evergreen tropical forest.

TABLE II.—*Rainfall.*

Month.	Iloilo, Iloilo.		Bacolod, Negros Occidental.	
	1903.	1905.	1903.	1905.
	mm.	*mm.*	*mm.*	*mm.*
January	5.5	2.8	51.3	31.4
February	1.5	8.9	13	3.1
March	3.3	0	6.3	1.6
April	4.8	32.4	2.8	1.1
May	165.6	60.7	91.3	112.1
June	244.3	175.8	178.1	145.9
July	427	603.1	334.6	388.7
August	186.2	277.5	200.2	425.5
September	146.3	148.8	298.4	227.6
October	245.6	342.8	223.3	362.5
November	124.5	60.6	149.7	165.5
December	528.3	48	429.2	158.7
Total (millimeters)	2,082.9	1,761.4	1,978.2	2,023.7
Total (inches)	82	69	78	80

ROADS AND TRAILS.

The tract is crossed by numerous foot and carabao trails, generally running in a north and south direction. They are used for the transport of bejuco and poles from the forest, and should be useful in the management and protection of the tract. Outside of the forest they unite with the main trails or roads leading to the towns and barios on the coast. These are uniformly bad foot and horse trails, almost impassable in the rainy season.

SOCIAL AND ECONOMIC CONDITIONS.

The Filipinos of the region are Visayans, who live on the cleared land along the coast but seldom in the forest, and a few roaming families of Negritos in the interior. About forty-five Visayan families, exclusive of the employees of the company, live within the tract, nearly all of whom are in its northwest corner and in the valley of the Himugaan River. They live on small farms, or caingins, 5 to 50 acres in area, on which they grow corn, tobacco, and camotes. Generally they are also collectors of bejucos, which they sell in the neighboring sugar haciendas or in the coast towns.

The chief occupations of the people of the costal strip of cleared land are fishing and farming. The principal agricultural products are sugar, corn, and tobacco. Sugar is grown on large estates, or haciendas, and requires considerable capital for its cultivation. Corn and tobacco are mostly grown by the poorer people on small farms or caiñgins. Owing to losses during the revolution and insurrection and to the destructive epidemic among the draft animals, many farms are abandoned at the present time. Nevertheless, the country is well settled. The municipality of Cadiz had a population of 16,429 and Sagay of 8,311 persons by the census of 1903. In general intelligence and industry the population is equal to that of any other agricultural region in the islands.

The forest needs of the population are limited. The mangrove swamps on the coast supply most of the necessary firewood and small timbers. From the mountain forest they gather bejucos, vines, resins, palm leaves, small poles, and a few large trees, from which they shape their bancas, or dugouts. For their legitimate personal needs, which should be satisfied, an insignificant amount of forest products is required from the tract.

OWNERSHIP OF THE LAND.

The timbered area of the tract, comprising 39,660 acres, is public land. All of the remaining 4,500 acres of cultivated and waste lands are either owned or claimed by private persons. Their titles, or claims, are based principally on possession. In no known case has any title to this land been registered in the court of land registration. However, the claim should be recognized as far as possible and all residents left in possession of the land which they now occupy.

THE COMPOSITION AND CONDITION OF THE FOREST.

CHARACTERISTIC TYPES.

On the tract there are three characteristic vegetative types. They are as follows: Waste-land type, river-valley forest type, and upland forest type. The two latter are natural; the first is the result of clearings made in the forest types.

Waste-land type.—In the Philippines the vegetation that occupies clearings or partial clearings has the general Tagalog name of "parang."[a] The kind of woody vegetation that springs up quickly in clearings is known by the Tagalogs as "calaanan" and by the Visayans as "laté," and is merely a subtype of the "parang." The "parang," or waste-land type, together with a small amount of cultivated land, comprises about 4,500 acres. A greater part of this is occupied by the "laté," the vegetation of which is composed of quick-growing weed trees that have little or no value. The following species are the most characteristic: *Trema amboinensis* Blume (Janagdon), *Psidium guayava* L. (Bayabas), *Homalanthus populneus* Pax. (Balanti), *Mallotus ricinoides* Muell. (Himlaamo), *Breynia rhamnoides* Muell. (Tulugtulug), *Ficus hauili* Blanco (Labnug), *Musa* sp. (Wild hemp), and many others. This type is only temporary and if protected from fire will gradually return to the original forest condition.

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[a] See Vidal, D. Sebastian: Catálogo Metódico de las Plantas Leñosas Silvestres y Cultivadas observadas en la Provincia de Manila (1880), 9–10, for the original definition of "parang;" also H. N. Whitford: The vegetation of the Lamao Forest Reserve, *Phil. Journ. Sci.* (1906), 1: 388–398, and W. W. Maule: Parang and Cogonales in the Philippines, *Forestry and Irrigation* (1906), 12: 311–317, for more detailed accounts of "parang" vegetation.

River-valley type.—At the lower limits of the tract the Himugaan River is winding and distinct terraces have been formed. As the stream is ascended these terraces become more narrow until finally on the upper half of the tract they disappear entirely, the river itself occupying a deep, narrow canyon. The terraces are valuable for agricultural purposes and, as shown by the map, the original forest has been cleared from a large portion of them. Probably there are 2,000 acres that are still in original forest. This estimate, which is liberal, includes the forest on the terraces near the mouths of the principal branches. A hurried examination of this type shows it to be in a poor sylvicultural condition. It is characterized by many species, most of which are small, crooked, and defective. The undergrowth is a dense mass of climbing bamboo, bejucos (rattan), wild hemp, vines, and shrubs. The commercial unimportance of the trees makes it doubtful if the Insular Lumber Company will ever find it advisable to log them. The land is better suited for agricultural than for forest purposes, consequently it may be found best to grant homesteads and permit caiñgins on it without consideration of the present forest growth.

Upland-forest type.—The commercial forest of the tract is of the upland type and has an area of about 37,600 acres (15,200 hectares), or 85 per cent of the entire tract. The merchantable timber which is being lumbered is on this type. The upland forest type, ranging from 150 to 1,200 feet elevation, covers the broad gentle slopes and ridges which lead up to the foothills and peaks of Mount Silay. The slopes are cut up by a number of small streams and numerous arroyos.

The forest itself is characterized by a numerous dominant stand of large overmature trees belonging to the family *Dipterocarpaceæ*, with an undergrowth of many small trees, making a forest remarkable for its density and yield.

The dominant trees important numerically and commercially are six in number, all Dipterocarps. They are Apitong (*Dipterocarpus grandiflorus* Blanco), Almon (*Shorea squamata* Dyer), Balacbacan (*Shorea polysperma* Merr.), Mangachapuy[a] (*Shorea* sp.), Lauan-dunlog (*Shorea contorta* Vid.) and Lauan-bagtican (*Shorea* sp.). Of the 32.9 trees per acre 40 centimeters (16 inches) and over in diameter, 29.4, or nearly 90 per cent, are the above species. They occur well mixed on every acre of upland forest. The average diameter of trees 40 centimeters and over is 71 centimeters (28 inches). The largest is Mangachapuy and the smallest Apitong. They are all tall, clear trees, with large buttresses, which attain a diameter of more than 150 centimeters (60 inches), a height of more than 60 meters (200 feet), and sometimes have a clear length of 30 to 40 meters (100 to 130 feet).

The minor species, though they occur in large numbers, are too small and too varied in quality to be of any great importance commercially. The average diameter of trees 40 centimeters and over is 49 centimeters (19 inches). Those which occur in largest numbers and for which a commercial use may be found are Ata-ata (*Diospyros* sp.), Dungula (*Vitex aherniana* Merr.), Guisoc-guisoc (*Hopea philippinensis* Dyer), Bulog (*Eugenia* sp.), and Moabog (*Canarium* sp.).

On the banks of small streams and in arroyos there is usually a very narrow fringe of small, unimportant trees. Here certain species are uniformly found. The most common are *Astronia cumingiana* Vid. and *Kayea* sp.

The upland forest, compared to most tropical timber forests, is lacking in dense underbrush. (Pl. II.) Climbing bamboos, bejucos, palms, and vines are regularly distributed through the forest, but only in a few spots, where an opening has been made admitting the light, do they form dense tangles, almost impossible to penetrate. As a rule, one can travel easily and steadily through the forest, cutting an occasional bamboo or bejuco from the path. The most common plants in the undergrowth are a *Pandanus* sp., bejucos, palms, climbing bamboos and vines, and numerous shrubs of the families *Rubiaceæ*, *Euphorbiaceæ*, *Melastomaceæ*, and others.

The heavy shade prevents a dense herbaceous growth in the ground cover. The most common plants are vines, herbaceous plants and seedlings of trees, bejucos, and palms. The characteristic species are a *Pandanus* sp. and a large sedge (*Mapania humilis* Naves).

The ground itself is remarkably free from litter. Heavy rains, insects, and fungi rapidly remove débris from the ground, leaving the soil bare, except for the scanty growth of small plants.

The silvical condition of the forest is bad. Most of the dominant trees are overmature and almost invariably diseased. The forest is balanced between growth and decay, with a big annual loss of increment which should be utilized. The mature and overmature trees should be removed as soon as possible to reduce the loss to a minimum and to enable the production of a second timber crop through the growth of the small trees and seedlings, which are abundant in the forest.

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[a] It should be stated here that this species is not the Mangachapuy of commerce.

Reproduction of the tree species is abundant and well distributed in the upland forest. (Pl. II.) There is a regular assortment of seedlings, saplings, small poles, large poles, and small trees to take the place of the large trees as they drop out. The deep shade beneath the large trees aids germination by keeping down a rank suffocating growth of vines, herbs, and grasses, which spring up in abundance in openings. On the other hand, this lack of light makes it difficult for the seedlings and saplings to survive and grow. Only a few of the millions of seedlings in the virgin forest finally reach a size where growth to maturity is practically assured. In short, the ground is usually a good seed bed. Seedlings of all species are sufficiently abundant and well distributed. Few seedlings reach the pole size, but enough do so to provide for the future of the forest.

The six principal species are well represented in the reproduction and evidently will continue to predominate in the forest in about the same proportions as in the past. They appear to seed periodically and abundantly. Seedlings of Mangachapuy and Almon are especially abundant at present, pointing to a recent heavy seeding of those species. The seeds of all appear to have germinated well. The seedlings endure considrable shade, and poles and small trees of all are present in satisfactory numbers. The advantage in shade endurance and persistency of growth under unfavorable conditions seems to lie with the Apitong and Almon.

Table III gives the total number of seedlings and saplings of trees and all other plants entering into the underbrush and ground cover ascertained by actual count on 15 plots, of one square rod each, regularly distributed through the upland forest in block 4.

TABLE III.—*Tree reproduction and ground cover on 15 square rods (375 square meters).*

Scientific name.	Common name.	Seedlings.	Saplings.
Dipterocarpus grandiflorus	Apitong	4	5
Shorea squamata	Almon	169	7
Shorea polysperma	Balacbacan	41	5
Shorea sp	Mangachapuy	896	1
Hopea philippinensis	Guisoc-guisoc	8	2
Vitex aherniana	Dungula	1	6
Diospyros sp	Ata-ata	19	6
Other tree species		57	20
Palmæ [a]	Palms	155	50
Calamus spp	Bejucos, or rattans	45	39
Pandanus sp	Pandan	29	1
Mapania humilis	Sedge	215	
Unknown plants [b]		583	65
Dinochloa sp	Climbing bamboo	(c)	(c)
Total		2,222	207

[a] Species of the genera Livistona, Pinanga, Oncosperma, and others.
[b] Mostly vines, some trees, with a few herbs and ferns.
[c] Abundant but not counted.

Table IV gives the average number per acre and hectare of poles and small trees of the six principal species, based on valuation surveys of 135 acres of upland forest in blocks 3, 4, 5, and 6.

TABLE IV.—*Stand of the small trees of the six principal species.*

Diameter above buttresses.		Stand per acre.						Stand per hectare.[a]					
		Apitong.	Almon.	Balacbacan.	Mangachapuy.	Lauan-bagtican and Lauan-dunlog.	Total.	Apitong.	Almon.	Balacbacan.	Mangachapuy.	Lauan-bagtican and Lauan-dunlog.	Total.
Inches.	*Cm.*												
4.7- 7.5	12-19	3.43	3.47	1.01	1.29	0.65	9.85	8.47	8.58	2.51	3.18	1.61	24.35
7.9-11.4	20-29	3.89	3.34	1.56	1.81	1.14	11.74	9.61	8.25	3.86	4.48	2.82	29.02
11.8-15.7	30.39	2.18	1.86	.94	.94	.56	6.48	5.38	4.59	2.32	2.32	1.39	16
Total		9.50	8.67	3.51	4.04	2.35	28.07	23.46	21.42	8.69	9.98	5.82	69.37
Percentage		33.8	30.9	12.5	14.4	8.40	100						

[a] 1 hectare=2.471 acres.

Sylvic treatment of the upland forest for its perpetuation and the production of timber is not difficult. The composition of the forest and the sylvics of the trees render a selection system of cutting, with protection of the reproduction, safe and certain to secure the desired results.

STAND AND YIELD OF UPLAND FOREST.

The merchantable timber on the concession is practically all in the 37,600 acres of upland forest, which is about 85 per cent of the total area of the tract. The valuation surveys and other measurements made to determine the volume of merchantable timber were confined to this type of forest. It is this type that the company will log, and to it that the chief provisions of the working plan apply.

Stand.—One hundred and thirty-five acres of the timber land in blocks 3, 4, 5, and 6 (mostly in 4 and 5), between the Hitalon and Himugaan rivers, were surveyed and the trees classified and measured according to species and diameter outside of the bark just above the main buttresses. From this data Tables V, VI, and VII were constructed, showing the average number of trees per acre and hectare. Although the surveys were made in a part of the tract comprising but 29 per cent of the total area, owing to the homogeneous character of the forest and the conservative nature of the figures, it is believed that they can be applied to the entire area of upland forest without serious error. It is safer, however, to confine their application to blocks 3, 4, 5, and 6.

Tables V, VI, and VII show the number of merchantable trees per acre and per hectare—that is, trees 40 centimeters and over in diameter. The six principal species are separated, except the two Lauans, which are comparatively few and nearly alike in all respects. The scarcity of the other species makes it inadvisable to separate them in this table. A tree 16 inches in diameter, besides its use for sawn lumber, will also serve for railroad ties and skids in road construction.

TABLE V.—*Number of trees per acre 40 centimeters and over in diameter.*

[Average of 135 acres in blocks 3, 4, 5, and 6.]

Diameter above buttresses.		Apitong.	Almon.	Balacbacan.	Mangachapuy.	Lauan-bagtican and Lauan-dunlog.	Total.	Other species.	Grand total.
Inches.	*Cm.*								
16	40	1.303	0 .800	0.548	0.652	0.400	3.703	1.185	4.888
18	45	1.334	.792	.518	.496	.260	3.400	.970	4.370
20	50	.933	.622	.446	.526	.185	2.712	.526	3.238
22	55	.740	.511	.303	.474	.170	2.198	.260	2.458
24	60	.763	.474	.385	.422	.111	2.155	.148	2.303
26	65	.659	.407	.429	.466	.140	2.101	.126	2.227
28	70	.451	.326	.266	.422	.133	1.598	.066	1.664
30	75	.446	.303	.237	.400	.096	1.482	.059	1.541
31	80	.260	.378	.223	.437	.074	1.372	.066	1 438
33	85	244	.355	.244	.370	.059	1.272	.037	1.309
35	90	.207	.185	.185	.281	.052	.910	.022	.932
37	95	.103	.133	.126	.318	.052	.732	.015	.747
39	100	.059	.207	.163	.289	.089	.807	.007	.814
41	105	.126	.260	.111	.446	.082	1.025	.007	1.032
43	110	.052	.170	.066	.393	.029	.710	....	.710
45	115	.015	.155	.052	.289	.037	.548	....	.548
47	120	.022	.163	.066	.370	.022	.643	....	.643
49	125	.022	.044	.066	.274	.015	.421	....	.421
51	130	.015	.044	.074	.237	.029	.399	....	.399
53	135	.007	.066	.037	.215	.022	.347	....	.347
55	140	....	.066	....	.281	.007	.354	....	.354
57	145	.007	.037	.022	.103	....	.169	....	.169
59	150	....	.037	.015	.118	....	.170	.007	.177
61	155	....	....	....	.052	....	.052	....	.052
63	160	....	.007	.007	.096	.007	.117	....	.117
65	165	....	....	....	....	....	....	....	....
67	170	....	.007	....	.030	....	.037	....	.037
Total		7.768	6.549	4.589	8.457	2.071	29.434	3.501	32.935
Percentage		23.6	19.9	13.9	25.7	6.3	89.4	10.6	100

TABLE VI.—*Number of trees per hectare*[a] *40 centimeters and over in diameter.*

[Average of 54.65 hectares in blocks 3, 4, 5, and 6.]

Diameter above buttresses.		Apitong.	Almon.	Balacbacan.	Mangachapuy.	Lauanbagtican and Lauandunlog.	Total.	Other species.	Grand total.
Inches.	*Cm.*								
16	40	3.22	1.98	1.35	1.61	0.99	9.15	2.92	12 07
18	45	3.29	1.96	1.28	1.22	.64	8.39	2.40	10.79
20	50	2.30	1.54	1.10	1.30	.46	6.70	1.30	8
22	55	1.83	1.26	.75	1.17	.42	5.43	.64	6.07
24	60	1.88	1.17	.95	1.04	.27	5.31	.36	5.67
26	65	1.63	1	1.06	1.15	.35	5.19	.31	5.50
28	70	1.11	.81	.66	1.04	.33	3.95	.16	4.11
30	75	1.10	.75	.59	.99	.24	3.67	.14	3.81
31	80	.64	.93	.55	1.08	.18	3.38	.16	3.54
33	85	.60	.88	.60	.91	.14	3.13	.091	3.221
35	90	.51	.46	.46	.69	.13	2.25	.054	2.304
37	95	.25	.33	.31	.78	.13	1.80	.037	1.837
39	100	.14	.51	.40	.71	.22	1.98	.018	1.998
41	105	.31	.64	.27	1.10	.20	2.52	.018	2.538
43	110	.13	.42	.16	.97	.071	1.751	....	1.751
45	115	.037	.38	.13	.71	.091	1.348	....	1.348
47	120	.054	.40	.16	.91	.054	1.578	....	1.578
49	125	.054	.11	.16	.68	.037	1.041	....	1.041
51	130	.037	.11	.18	.59	.071	.988	....	.988
53	135	.018	.16	.091	.53	.054	.853	....	.853
55	140	....	.16	....	.69	.018	.868	....	.868
57	145	.018	.091	.054	.25	....	.413	....	.413
59	150	....	.091	.037	.29	....	.418	.018	.436
61	155	....	....	....	.13	....	.13	....	.13
63	160	....	.018	.018	.24	.018	.294	....	.294
65	165	....	....	....	....	....	....	....	....
67	170	....	.018	....	.074	....	.092	....	.092
Total		19.158	16.178	11.32	20.854	5.114	72.624	8.626	81.25

[a] 1 hectare = 2.471 acres.

TABLE VII.—*Number of trees of the six principal species 12 centimeters (4.7 inches) and over in diameter.*

[Average of 135 acres (54.65 hectares) in blocks 3, 4, 5, and 6.]

	Apitong.	Almon.	Balacbacan.	Mangachapuy.	Lauanbagtican and Lauandunlog.	Total.
Per acre..................................	17.26	15.22	8.11	12.50	4.42	57.51
Per hectare..............................	42.6	37.6	20	30.8	10.9	141.90
Percentage..........................	30	26.5	14.1	21.7	7.7	100

Volume tables.—To ascertain the volume of the timber in these trees and on each acre, measurements of 57 felled trees of Apitong, Mangachapuy, Almon, and Balacbacan were made. The following measurements were taken: Height of stump, diameter outside the bark on the stump, diameter outside the bark every 5 meters as far as the tree was merchantable, thickness of bark, and the clear length of the tree. The diameter on the stump is in nearly all the trees the point where the large buttresses end, and corresponds with the diameters measured in the valuation surveys. The total length could not be measured because of the great breakage of the tops in falling, which would have made such measurements too uncertain. A 5-meter log section in measuring the diameter was found very convenient, as it is equivalent to 16 feet, the standard log length.

From the measurements of the 57 trees, the volume of each in cubic meters and in feet, board measure, by the Doyle rule, was computed. Since so few trees were measured, it was not advisable to make a separate volume curve and table for each species. They happen, however, to have a similar habit of growth, being all large, clean-boled trees, with small taper. Consequently, all measurements were combined to make one volume curve in cubic meters and one in feet, board measure, to be applicable to all of the principal species. The following volume table was constructed from the volume curves. In this table no allowance is made for defects in logs that are merchantable, but unmerchantable logs were not measured. Allowance for defects in individual trees can not be made from the data collected. Small trees are usually very slightly defective, while large trees are almost always attacked by heart rot.

The tree in the United States which most closely resembles in shape and volume the large Dipterocarps on the tract is the Yellow Poplar (*Liriodendron tulipifera* L.). The actual number of board feet sawed out of Yellow Poplar trees of the different diameters is given in Table VIII for purposes of comparison.[a] The Dipterocarps are more defective than the Yellow Poplar, and allowance for these defects will overcome the difference in their favor shown in the table.

TABLE VIII.—*Volume table for the six principal species, based on measurements of 57 trees*[a] *compared with Yellow Poplar.*[b]

Diameter above buttresses.		Apitong, Almon, Balacbacan, Mangachapuy.		Yellow Poplar (feet B. M).	Diameter above buttresses.		Apitong, Almon, Balacbacan, Mangachapuy.		Yellow Poplar (feet B. M).
Inches.	Centimeters.	Feet B. M., Doyle rule.	Cubic meters.		Inches.	Centimeters.	Feet B. M., Doyle rule.	Cubic meters.	
16	40	150	1.12	191	43	110	3,950	13.13	3,146
18	45	250	1.50	276	45	115	4,400	14.50	3,470
20	50	400	2	380	47	120	4,950	16	3,801
22	55	580	2.50	507	49	125	5,550	17.46	4,144
24	60	800	3.18	657	51	130	6,100	19	4,497
26	65	1,050	3.84	832	53	135	6,550	20.40	4,844
28	70	1,310	4.60	1,035	55	140	6,900	21.70	5,154
30	75	1,600	5.40	1,250	57	145	7,200	22.80	5,435
31	80	1,880	6.26	1,359	59	150	7,450	23.70	5,700
33	85	2,200	7.27	1,585	61	155	7,630	24.40	5,944
35	90	2,500	8.40	1,832	63	160	7,780	25	6,174
37	95	2,820	9.40	2,149	65	165	7,900	25.50	6,394
39	100	3,150	10.57	2,478	67	170	8,000	25.80	6,604
41	105	3,500	11.80	2,827					

[a] No allowance for defects.

[b] Actually sawn from the trees of Yellow Poplar cut in Tennessee, United States.

Yield.—With the average number of trees per acre and per hectare of the principal species and their average contents, the total volume per acre and per hectare, without allowance for defects, is computed in feet, board measure, and cubic meters for Tables IX and X. The minor species are not included in this estimate because of their small numbers, small size, and unimportance. Further investigation may show that somd of them can be introduced into the markets, but at present they are not exploited.

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[a] See Braniff, E. A.: Grades and Amount of Lumber Sawed from Yellow Poplar, etc., *U. S. Dept. Agr.*, *For. Ser.* (1906), Bull. 73.

TABLE IX.—*Volume per acre of the six principal species.*

[No allowance for defects. Feet B. M., Doyle rule.]

Diameter above buttresses.		Apitong.	Almon.	Balacbacan.	Mangachapuy.	Lauan-bagtican and Lauan-dunlog.	Total.
Inches.	*Cm.*						
16	40	195	120	80	95	60	550
18	45	335	200	130	125	65	855
20	50	375	250	180	210	75	1,090
22	55	430	295	175	275	95	1,270
24	60	610	380	310	340	90	1,730
26	65	690	425	450	490	145	2,200
28	70	590	425	350	555	175	2,095
30	75	710	485	380	640	155	2,370
31	80	490	710	420	820	130	2,570
33	85	530	780	535	815	130	2,790
35	90	520	460	460	700	130	2,270
37	95	290	375	355	895	145	2,060
39	100	185	650	515	910	280	2,540
41	105	440	910	390	1,560	285	3,585
43	110	205	670	260	1,550	115	2,800
45	115	65	680	230	1,270	160	2,405
47	120	110	805	325	1,830	110	3,180
49	125	120	240	365	1,520	85	2,330
51	130	90	270	450	1,445	175	2,430
53	135	50	430	240	1,410	145	2,275
55	140	....	455	....	1,940	50	2,445
57	145	50	265	160	740	....	1,215
59	150	....	275	110	880	....	1,265
61	155	....	....	....	395	....	395
63	160	....	55	55	770	55	935
65	165	....	....	....	....	....	....
67	170	....	60	....	240	....	300
Total		7,080	10,670	6,925	22,420	2,855	49,950
Percentage		14.2	21.4	13.9	44.8	5.7	100

TABLE X.—*Volume per hectare of the six principal species.*

[No allowance for defects. Measurement in cubic meters.]

Diameter above buttresses.		Apitong.	Almon.	Balacbacan.	Mangachapuy.	Lauan-bagtican and Lauan-dunlog.	Total.
Inches.	*Cm.*						
16	40	3.60	2.21	1.51	1.80	1.10	10.22
18	45	4.93	2.94	1.92	1.83	.96	12.58
20	50	4.60	3.08	2.20	2.60	.92	13.40
22	55	4.57	3.05	1.87	2.92	1.05	13.46
24	60	5.98	3.72	3.02	4.45	.86	18.03
26	65	6.26	3.84	4.07	4.41	1.34	19.92
28	70	5.10	3.72	3.03	4.78	1.52	18.15
30	75	5.94	4.05	3.18	5.34	1.30	19.81
31	80	4.00	5.82	3.44	6.76	1.12	21.14
33	85	4.36	6.39	4.36	6.61	1.02	22.74
35	90	4.28	3.86	3.86	5.79	1.09	18.88
37	95	2.35	3.10	2.91	7.33	1.22	16.91
39	100	1.48	5.39	4.23	7.50	2.32	20.92
41	105	3.66	7.55	3.18	12.98	2.36	29.73
43	110	1.70	5.51	2.10	12.73	.93	22.97
45	115	.54	5.51	1.88	10.29	1.32	19.54
47	120	.86	6.40	2.56	14.56	.86	25.24
49	125	.94	1.92	2.79	11.87	.65	18.17
51	130	.70	2.09	3.42	11.21	1.35	18.77
53	135	.37	3.26	1.85	10.81	1.10	17.39
55	140	....	3.47	....	14.97	.39	18.83
57	145	.41	2.08	1.23	5.70	....	9.42
59	150	....	2.15	.87	6.87	....	9.89
61	155	....	....	....	3.17	....	3.17
63	160	....	.45	.45	6.00	.45	7.35
65	165	....	....	....	....	....	....
67	170	....	.46	....	1.90	....	2.36
Total		66.63	92.02	59.93	185.18	25.23	428.99

For a safe and conservative estimate of the merchantable timber per acre, an allowance for defects should be made of about 20 per cent for Apitong, 40 per cent for Mangachapuy, and 30 per cent for Balacbacan, Almon, Lauan-bagtican, and Lauan-dunlog. This allowance is made in Tables XI and XII. Since it may be advisable to place the merchantable diameter or cutting limit at 20 inches instead of 16 inches, the merchantable stand and yield for trees above those two diameters, respectively, are given in those tables for the purpose of comparison.

TABLE XI.—*Summary of stand and merchantable yield of the six principal species 40 centimeters (16 inches) and over in diameter.*

[Allowance for defects: Apitong, 20 per cent; Mangachapuy, 40 per cent; others, 30 per cent.]

Species.	Stand.		Yield.	
	Per acre.	Per hectare.	Doyle rule, feet B. M. per acre.	Cubic meters per hectare.
Apitong	7.77	19.16	5,670	53.3
Almon	6.55	16.18	7,470	64.4
Balacbacan	4.59	11.32	4,850	42.0
Mangachapuy	8.45	20.85	13,460	111.1
Lauan-bagtican and Lauan-dunlog	2.07	5.11	2,000	17.7
Total	29.43	72.62	33,450	288.5

TABLE XII.—*Summary of stand and merchantable yield of the six principal species 50 centimeters (20 inches) and over in diameter.*

[Allowance for defects same as in Table XI.]

Species.	Stand.		Yield.	
	Per acre.	Per hectare.	Feet B. M. per acre.	Cubic meters per hectare.
Apitong	5.13	12.65	5,140	44.8
Almon	4.96	12.24	7,150	59.3
Balacbacan	3.52	8.69	4,640	38.6
Mangachapuy	7.31	18.02	13,240	107.5
Lauan-bagtican and Lauan-dunlog	1.41	3.48	1,880	15.7
Total	22.33	55.08	32,050	265.9

The data from which the volumes and yields are obtained is clearly insufficient to permit of an accurate estimate. This is not claimed for the above tables. They will, however, be found approximately correct and will serve as a basis for management until they can be revised. They apply to blocks 3, 4, 5, and 6, but are generally applicable to the entire area of upland forest.

This tract, having about 32,050 feet B. M. of merchantable timber (over 20 inches in diameter) per acre on 37,660 acres of forest land, therefore contains a total merchantable stock of 1,207,000,000 feet B. M., if the above yield will hold for the entire area of commercial forest, which is probable. This should be cut as rapidly as possible. It is sufficient to supply a mill cutting 100,000 feet per day for forty-two years of three hundred working days per year.

DESCRIPTION OF TREES.

Principal species.—Apitong (*Dipterocarpus grandiflorus*): Apitong is an important timber tree of the third group, found generally in the hill forests throughout the islands, the timber of which comes into the market in large quantities. On this tract Apitong occurs in abundance, singly, in mixture with other species, or in small groups. It is most numerous on the slopes of the upland forest, where it is often found in almost pure groups on the tops of hills and ridges. Apitong rarely occurs above 1,800 feet elevation on Mount Silay. It prefers a deep, well-drained soil.

Apitong is a smaller tree than any of the other five principal trees, although it reaches a diameter of 145 centimeters (57 inches), with a clear length of 25 to 30 meters

(80 to 100 feet). The majority of the trees, however, are small. This probably is not due altogether to natural conditions, but more to the long-continued and injurious boxing of the trees for the balao, or pitch, which it yields.

In the forest the Apitong is a clean-looking, tall tree, with a straight cylindrical trunk, short, compact crown, and low moderate butresses, or none at all. Apitong endures shade remarkably well, but thrives best in the stronger light on the upper slopes or tops of hills. Although seedlings are comparatively few, saplings, small poles, and large poles are present in a proportion sufficient to provide for the future of the species in the forest. Apparently it seeds well, but intermittently. No 1-year-old seedlings were observed during the field work of the past year.

Apitong is the freest from defect of the six principal species. It is sound except when it has been subjected to boxing. That the boxing is injurious and responsible for the death of many trees was proven by the observations of the various stages of decay and death of trees which, without exception, had been boxed. Notches 8 to 12 inches deep are hollowed out below to catch the pitch as it oozes out of the wood. Trees of only 40 centimeters diameter are often tapped, and large trees frequently on two sides. The balao is collected and the box is burned out every two weeks. In a short time insects and fungi take hold and the decay is rapid.

The wood of the Apitong is heavy, moderately hard, and fairly durable. It is reddish brown in color and has a straight but coarse grain. It is used in ordinary construction, in shipbuilding, and for inferior furniture. Apitong sells in Manila for ₱90 to ₱115 per 1,000 feet B. M.

Almon or *White Lauan* (*Shorea squamata*): Almon is one of the important timber trees, the timber of which enters the market as White Lauan.[a] (Pl. I, frontispiece.) It occurs in mixture with other species throughout the tract, most numerous on the rich gentle slopes.

It is a very large, tall, clear tree, attaining a diameter of 170 centimeters (67 inches), a height of more than 65 meters (210 feet), and a clear length of 35 meters (115 feet). In the forest it is straighter and clearer than the other species and is characterized by less taper. A tree 135 centimeters in diameter on the stump had the following diameters outside the bark at the small end of each 5-meter log: 114, 112, 111, 103, 101, 96, and 93 centimeters, a total taper in 35 meters (115 feet) of 42 centimeters (16 inches), 21 centimeters (8 inches) of which was in the first 5-meter log.

The crown of Almon is short, sturdy, and compact. Large, high buttresses are almost invariably found on the big trees, sometimes 3 meters high and reaching from 3 to 4 meters from the base of the tree.

Almon may be classed as a fair shade endurer, although its clear, tall habit of growth shows a strong desire for light. Seedlings are not numerous in the forest, but the number of saplings and small and large poles is only exceeded by that of the Apitong.

The large trees of Almon and many of the small ones are very defective. The principal defect is a punk or rot in the heart, which varies from a small doty spot, making the heart boards useless, to large hollows extending the full length of the tree. This has probably been caused by injuries to the tops, which have permitted the entrance of destructive fungi.

The wood of Almon is light brown in color, rather soft, and not heavy. It is used mostly for interior work in the construction of houses. It is also substituted for Balacbacan for interior finishing and for furniture. Almon does not endure exposure to moisture or weather, and is very susceptible to the attacks of anay, or the white ant. It is sold in Manila for ₱70 to ₱90 per 1,000 feet B. M.

Balacbacan or *Tanguile* (*Shorea polysperma*): Balacbacan, the timber of which is now well known in the market, occurs well distributed on the tract in mixture with the other species. It prefers deep soil on the slopes of the hills and is more numerous above 500 feet elevation. It is found on Mount Silay to an elevation of about 2,500 feet.

Balacbacan is a large timber tree not reaching the magnificent sizes of the Mangachapuy, but attaining a diameter of 160 centimeters (63 inches), a height of more than 50 meters (165 feet), and a clear length of 30 meters (100 feet). It is characterized by a stout spreading crown and a straight cylindrical trunk, with prominent buttresses at the base. It, as well as the other species of the genus Shorea in the forest, is defective at the heart. In general, however, it is less so than the others.

Reproduction of Balacbacan is fairly well distributed in the forest. Seedlings and saplings are not so numerous as those of Mangachapuy. The tree endures shade about as well as the Almon.

The wood of Balacbacan is porous, light in weight, and red or reddish brown in color. It is used extensively for interior finish and for furniture, and is now received with favor in Manila, where it is sold for ₱70 to ₱90 per 1,000 feet B. M. The wood closely resembles that of Mangachapuy, which has been sold in the markets under the name of Balacbacan.

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[a] This wood should not be confused with that of *Shorea contorta*, the White Lauan of Mindoro, Zambales, and other provinces.

Mangachapuy or *Red Lauan* (*Shorea* sp.): Mangachapuy, known in the market as Red Lauan and Balacbacan, is both the largest and the most important timber tree on the concession. It occurs throughout the tract in mixture with other species, most numerous on the rich, moist, lower slopes and nearly level land of the upland forest.

Mangachapuy here reaches magnificent sizes. Trees 150 to 180 centimeters (60 to 70 inches) in diameter, towering to a height of more than 65 meters (215 feet), with clear lengths of 30 to 35 meters (100 to 115 feet), are not uncommon. It is characterized by stout, long, cylindrical trunk, immense buttresses, and sturdy spreading top.

The Mangachapuy endures shade well. Seedlings, saplings, and small and large poles are abundant. (Pl. II.) It is evident from the abundance of small seedlings that a heavy seeding of this species occurred one or two years ago.

The Mangachapuy is the most defective of the principal species. The large trees are all subject more or less to dote, or rot, at the heart, and it is difficult to find a small specimen which is not already slightly affected.

The wood of Mangachapuy is sold in the markets as Balacbacan or Red Lauan. It is porous, red in color, and light in weight. Locally it is used in the construction of houses and bancas, or dugouts. It is now being used extensively for interior finish and furniture. It is sold in Manila for ₱70 to ₱90 per 1,000 feet B. M.

Lauan-dunlog (*Shorea contorta*) and *Lauan-bagtican* (*Shorea* sp.): These two trees are relatively few on the tract. Lauan-dunlog is the White Lauan of commerce. Both occur in mixture, preferring the moist, steep slopes in the upland forest near streams, and are also scattered in the river-valley forests. The close resemblance between the two species and the difficulty of distinguishing them in the woods makes it advisable to treat them as one. Both are large trees, attaining a diameter of 150 centimeters (60 inches). They resemble in general form the Almon already described, and are subject to heart rot and other diseases to about the same degree as Almon. In proportion to their numbers in the forest, reproduction is satisfactory. Their wood has, in general, the same characteristics and uses as Almon, but is a trifle harder and heavier. They are sold in the markets as White Lauan.

Minor tree species.—The many minor tree species scattered over the tract in small numbers and sizes are of little or no importance commercially. The following list includes the larger and the more numerous: *Diospyros* sp. (Ata-ata), *Vitex aherniana* (Dungula), *Hopea philippinensis* (Guisoc-guisoc), *Canarium* spp. (Moabog), *Eugenia* spp. (Bulog), *Kurrimia luzonica* Vid., and *Livistona* sp. (Palma brava). These trees are so well distributed through the forest that large numbers of no one species can be found within a prescribed area. There are but 2.55 trees per acre 40 centimeters and over in diameter. They are all small, dominated trees, growing in the shade of the large Dipterocarps. Although many of them doubtless possess value for some purposes, only three (Dungula, Ata-ata, and Palma brava) can have any importance at present to lumbermen.

Dungula,[a] which belongs to the same genus as Molave, is a small tree, seldom exceeding 60 centimeters (24 inches) in diameter, and occurs well distributed throughout the forest, but is most numerous on moist, gentle slopes and near streams. It is a small, rather crooked, ill-formed tree, growing in the shade of the dominant Dipterocarps. It is a true shade endurer and reproduces well.

The wood of Dungula is very hard and heavy, resembling Molave so closely that it is often substituted for that species in the Manila market. It is extremely durable in the ground. Fallen Dungula trees in the forest, after the narrow sapwood has rotted off, remain hard and sound, although it is evident that they have laid on the ground for a long time. Dungula is gladly used by the inhabitants of northern Negros for harigues, or house posts. It has not, however, because of its relative scarcity and small size, which makes logging costly, been introduced into the timber market on any scale. There is no doubt that it is a very satisfactory timber for small house posts, railroad ties, and mining timbers, especially for the latter.

Ata-ata is a small tree belonging to the same family as the valuable Ebony and Camagon. It resembles very closely Bolongeta (*Diospyros pilosanthera* Blanco). Ata-ata seldom forms more than 1 to 2 inches of the black heartwood which makes species of the ebony family valuable for cabinetwork. For construction purposes it is hard and strong. Ata-ata occurs throughout the forest in the lower dominated story. It is more numerous on the lower gentle slopes. It is a straight, well-formed tree, often slightly rectangular in cross section at the base. Its deep blue-black bark gives it a striking appearance in the forest. It reproduces well and endures heavy shade.

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[a] This tree is known in Manila markets as Sasalit, the common name for it in Zambales. In portions of Tayabas it is called Igang.

The following table shows the sizes and number of trees per acre and hectare of Dungula and Ata-ata:

TABLE XIII.—*Stand of Dungula and Ata-ata.*

[Average of 135 acres in blocks 3, 4, 5, and 6.]

Diameter above buttresses.		Number of trees per acre.		Number of trees per hectare.	
		Dungula.	Ata-ata.	Dungula.	Ata-ata.
Inches.	*Centmeters.*				
12	30	0.511	0.407	1.262	1.005
14	35	.385	.644	.950	1.590
16	40	.082	.289	.203	.714
18	45	.155	.178	.383	.439
20	50	.082	.059	.202	.146
22	55	.022	.029	.054	.072
24	60	.022	.0073	.054	.018
26	65	.0073	....	.018	....
28	70	....	....	....	....
30	75	.0073	....	.018	....
31	80	.0073	....	.018	....
33	85	....	.0073	....	.018
35	90	....	....	....	....
37	95	....	....	....	....
Total 40 centimeters and over		.3849	.5696	.950	1.407
Total 30 centimeters and over		1.2809	1.6206	3.162	4.002

Palma brava, or Anahao, is a very useful tree locally, although it reaches no large size. Its poles are used in house construction, usually split for flooring. Its large leaves are used extensively for thatching. It occurs generally on the moist slopes, but the better trees have been badly thinned out in the lower edge of the tract. Farther back it occurs in considerable amounts as a very tall, clear tree, up to 30 centimeters in diameter.

The minor species will be generally used in railroad and skid-road construction. Dungula, however, should be exploited and introduced into the market. As fast as investigation shows that any other of the minor species possesses a commercial value, it should be exploited by the company.

INJURIES TO WHICH THE FOREST IS LIABLE.

The forest is subject to damage from natural and artificial causes. To the former belongs the damage caused by insects, fungi, and winds; to the latter the damage caused by logging, fires, and caiñgins. The latter are by far the most important.

Damage from natural causes.—The amount and importance of the insect damage are not yet known. There is a beetle (*Crossotarsus* sp.) which bores into the log soon after the trees are felled, making it inadvisable to cut the trees more than a few days ahead of the skidding. The injury is greatest during the wet months of March and April. Since it is impossible to remove all the bark from the logs in the woods, peeling them immediately after cutting is ineffectual. It will always be necessary to remove the logs from the woods within a week after felling. The damage done by this insect appears in the lumber as small black pin holes.

Fungi, though useful in cleaning the forest, inflict great injury. The prevalent heart rot in the various species of Shorea is due to a number of fungi not yet determined. Apparently the spores of fungi enter through some injury in the tops of the trees. The disease then rapidly works down through the soft heart. Year by year the work continues, until the tree is only a hollow shell. All large trees of the genus *Shorea* are affected in this way to a certain extent. The only remedy now possible is to cut the diseased trees as soon as possible, thus removing the centers of infection and lessening the loss of timber. Since the entire tract is covered by mature timber almost equally damaged by this disease, the entire area should be logged off as soon as possible.

The damage from windfall is here negligible. The only trees observed blown down by the winds were overmature and diseased. Wind thus merely assists the ants, anay, and fungi in removing the dead trees from the forest.

Damage from artificial causes.—Forest fires in the untouched timber are impossible, because of the evergreen, moist character of the forest, and the lack of dry undergrowth and litter. In the cutting area after logging, however, there is considerable danger during the dry months of March and April, when the great quantity of tops and other débris is well dried out, that a fire will sweep through, destroying the reproduction and killing many of the remaining trees. Yet, even in the cuttings a fire must be set at the opportune time, with a favoring wind, in order to spread over any large area. A moderate degree of watchfulness will prevent accidental fires in the slash.

The principal and important injury to the forest is caused by caiñgins, or clearings. (Pls. III and IV.) Caiñgins are a system of shifting agriculture. They are small clearings, rarely exceeding 25 acres in area, made in timber or brush land by ignorant, irresponsible persons. The undergrowth, small trees, and some of the large trees are cut during the months of January, February, and March. In April, just before the spring rains, the dried mass is fired. If the weather has been favorable, the fire burns eagerly and leaves only charred trunks and stumps to hinder planting. Crops of corn, camotes, and sometimes tobacco are carelessly cultivated for one, two, or three years, until grass and other weeds make cultivation difficult. Then the auther of the caiñgin abandons it to find another spot in the forest in which to repeat the operation.

The problem of protecting the tract against this danger is made more difficult by the attitude of the owners of several sugar plantations adjacent to the northern boundary, who evidently encourage and inspire many of the clearings in the public forest, with the object of securing the land after it is abandoned by the authors of the caiñgins. Recently they have attempted to secure the land through homesteads made by persons dependent upon them. Where such applications have been made for land which is suitable for agriculture, and on which there is little or no merchantable timber, it has been certified as more valuable for agricultural than for forest purposes. In many cases, however, applicants for heavily timbered land have made clearings immediately after, if not before, making their applications and before receiving the approval or disapproval of their applications. In this way, much valuable and accessible timber within the tract granted the Insular Lumber Company has been destroyed. From this a difficult problem has arisen in regard to the land suitable for agriculture. On such lands covered with timber which will be exploited by the Insular Lumber Company, it is evident that homesteads should not be allowed until the timber has been removed, or should only be granted under the condition that no clearings be made until the land has been logged by that company. But if the applicants have entered the forest and made clearings on the land prior to its examination by the forest officer, there is then no reason why the homesteads should not be approved. The forest officer can, however, have the applicants punished for making the caiñgins without permission, but this will not affect the final disposition of the land nor compensate for the timber destroyed. This problem was met during the past year in heavily timbered land in block 7, adjoining a neighboring plantation.

The punishment of men making caiñgins without permission in the public forests, as provided in article 25 of the Forest Law, will not alone serve to remedy the evil. Imprisonment has no great terror for the offenders, and they are seldom able to pay the fines imposed. During the fiscal year 1905 about 300 acres of caiñgins were made in heavily timbered forest along the northern boundary of the tract, which destroyed about 7,000,000 feet B. M. of merchantable timber. Ten offenders were arrested and punished with from five to thirty-five days' imprisonment each, but no fines could be collected for the timber destroyed. On their release from prison they returned to their clearings, which they are now cultivating. It is absolutely necessary to protect this tract against caiñgins in order to initiate even the simplest plan of forest management and regulation. Prevention is the only means. This can be done by—

First. Marking and posting warning notices along the northern boundary line.

Second. Patrolling the forest where there is danger of caiñgins.

Third. Marking the boundaries of existing clearings within the tract to prevent their extension by means of caiñgins.

Fourth. Permitting caiñgins on the partially timbered land outside of the tract.

Injuries from logging are unavoidable. Small trees will be crushed in felling large ones, and seedlings will be destroyed. It is necessary, however, that care be taken to make this injury as small as possible. Damage from logging will be treated more fully under a succeeding heading.

THE UTILIZATION OF THE FOREST.

TIMBER.

History of lumbering.—Lumbering in northern Negros previous to 1903 was carried on in a desultory manner by the Spanish and Filipino licensees. They hauled the timber to the nearest streams by carabao, where the logs were made into rafts and towed to the Iloilo market, about 70 miles distant. It is reported that fine Molave and Narra were obtained in Spanish times along the coast in Cadiz and Sagay. The forest of third and fourth group trees, which covered most of the area, was gradually pushed back to its present position. The timber of this forest has always been in disfavor with the Spaniards and Filipinos, and doubtless very little of it in the destroyed forest of this type was utilized.

Lumbering on the tract itself has a brief history. Previous to 1903 practically no timber had been exploited, except for local needs, although clearings had made inroads along the northern side. In 1903 a license to cut 100,000 cubic feet of timber in the sitio of Sanghai, on both sides of the Himugaan River, was granted to the Iloilo Electric Company. This company installed the present small circular-saw mill, having a capacity of about 15,000 feet B. M. per day, and a logging outfit of one donkey engine, wire cable, etc.

This preliminary and experimental operation, though not a financial success at the time, owing to the difficulty of introducing species against which the markets were prejudiced, and to floods which caused considerable damage to the mill and carried off many logs, nevertheless demonstrated to the satisfaction of the promoters that a large and modern plant, operated on American principles, would pay, and that steam logging was the best method to use in exploiting the large timber of this forest.

In 1904 the Insular Lumber Company, incorporated under the laws of the State of New York, took over the plant of the Iloilo Electric Company and secured the present concession under a license agreement to exploit the timber on the tract for a period of twenty years. In return, it bound itself to comply with certain cutting rules and other regulations. It was its intention to install at once a new mill, of 100,000 or 200,000 feet capacity per day; but various difficulties prevented its accomplishment until the present year. The new mill is now being installed and will be completed in the near future.

The Iloilo Electric Company and the Insular Lumber Company have logged off about 250 acres from July 1, 1903, to July 1, 1906, most of which was cut over by the latter company. In 1903–4 the former company manifested about 300,000 feet B. M., for which they paid about $1.33, gold, per 1,000 feet B. M. The Insular Lumber Company has manifested in the first two years of its existence about 1,770,000 feet B. M., for which it paid about $1.06, gold, per 1,000 feet B. M. This amount manifested does not include a large amount of lumber used in the construction of the plant and on which no Government charge has been imposed.

The discrepancy between the large area cut over and the relatively small amount of timber manifested is accounted for by the unusual waste in logging, by the small size of the mill, which could not handle the largest trees, by leaving the White Lauans standing over a large part of the area because it was not marketable, and by the fact that the company had the free use of timber for construction purposes on the tract during the past two years.

Present lumbering operations.—General conditions: Differences in climate, transportation, and labor, as well as in the timber, make successful lumbering in the Philippines more difficult than in the United States. The Insular Lumber Company, under able management, has been meeting these difficulties and has gradually overcome them.

A lumberman in the Philippines has to choose between locating his mill near the forest or in one of the large towns or markets. The larger mills are found in Manila. The five largest mills in the Islands are in Manila and have a total daily capacity of 100,000 feet B. M., although the actual amount cut is less than half the capacity. Transportation of logs and lumber is entirely by water, and for long distances logs or lumber are not rafted. Mills which purchase their logs in the market are better located in the cities. The Insular Lumber Company, however, having an almost unlimited supply of available timber and the necessary means to log it, and having a a deep, navigable river penetrating almost to its timber, rightly decided to place its mill on this river as close as possible to the forest and to ship the sawn lumber to Manila and the other markets.

The great size and weight of the timber on the tract made it necessary to employ some other system in logging than the ordinary native method. Carabaos are scarce and expensive, and, in addition, are unable to haul the largest logs. Steam skidding and hauling seemed the only method available. The forest is one easily logged. The configuration of the ground is favorable to steam skidding and railroad transportation. Roads can be built with much less grading and bridging than in the forests of western Washington. The hot climate is not a hindrance in the mill or woods, and during the rainy season logs are more easily skidded.

A sufficient supply of good native labor is essential for a large lumbering operation, like that of the Insular Lumber Company. Fortunately, it has located in a populous region, where there is a laboring population employed on large sugar estates. Consequently the company has not encountered great difficulty in securing a force of about 80 Filipino workmen. The efficiency of the labor, judged by American standards, is low, but compared with similar labor in other parts of the Islands, stands high. The men work fairly steadily, are docile, and easily taught. Among them the company now has some who do very good work in the woods and in the sawmill. They are treated well, furnished with good frame houses without rent, and are paid about ₱0.50 per day. Those who become skilled in special work receive slightly higher wages. As the ordinary wage paid on the sugar estates is ₱1 to ₱1.50 per week, with food, the company has little difficulty in securing and keeping its native labor. It is a more difficult problem to obtain and keep skilled American labor, which has to be secured from the United States. Only high salaries will bring suitable American sawyers or loggers to this country, and even then they will not make long-time contracts.

Logging: This company and the Iloilo Electric Company have logged about 250 acres of forest land since August, 1903. The logging camp still stands at the place where cutting was first begun on the bank of the Himugaan River, less than 1 mile from the sawmill. The logs are hauled to this point and rolled over the steep bank to the river. A group of houses for the employees, a machine shop, and the hauling donkey engine are also located at this place. From the landing a hauling road extends 1 mile west into the forest, where the cutting is now going on.

The method used in logging is an exact copy of the steam logging system used in western Washington. (Pls. V, VI, VII, and VIII.) The outfit consists of one large hauling donkey, of about 50 horsepower, about 1 mile of 1-inch hauling cable, about 1 mile of three-fourths-inch haul-back cable, one skidding or yarding donkey of about 40 horsepower, over 2,000 feet of three-fourths-inch yarding cable, and the necessary blocks, hooks, rollers, chokers, cant hooks, axes, saws, etc.

The rollway or landing is the almost perpendicular river bank, here nearly 100 feet high—much higher than is necessary or desirable. From the hauling donkey stationed at the top (Pl. V) a nearly straight road, about 10 feet wide, has been made into the forest. This is carefully graded and has strong bridges over the few arroyos or gulleys. (Pl. VI.) Across the road, and about 6 feet apart and buried about one-half in the earth, are placed skids or sleepers, 8 feet long and 14 to 20 inches in diameter, notched at the middle to about the level of the ground. The timber is hauled over these skids. From this main road radiate short skid roads or trails not more than 1,000 feet long. These are simple dirt roads, without grading. The hauling cable from a drum on the engine at the rollway runs on the ground along the hauling road and over iron rollers where a turn in the road makes this necessary. At the end of the road, where the yarding donkey is set up (Pl. VII), the hauling cable passes through a block and returns as the haul-back cable to another drum on the engine. The yarding cable runs from the yarding engine in a similar manner into the forest over a skid road, through a block and back again. Parallel to these cables are wires connected with the whistles on the engines, by which signals are given to the engineers.

The trees are felled with ax and saw by fellers working in pairs. A staging is built of small poles to enable them to get above the large buttresses. (Pl. I.) A tree is notched on one side, sawed on the other, and wedged over, if necessary, until it falls. One felling crew of two men cuts three or four large trees per day. Other men then cut up the tree into logs 16 and 32 feet long, and occasionally 12, 18, 20, and 24 feet long. (Pl. VIII.) The logs are then nosed at one end, and if very large are barked on one side to make hauling easier. The skidding crew place a choker (noose of cable) around the log and fasten it to the end of the skidding cable, signal the skidding engine, and the log is pulled out and hauled to the main road. When several logs (usually two when the skids are dry, and four or more when they are wet) lie on the main road, they are coupled together by hooks or grabs driven into their ends and connected by cable. The head log is fastened to the hauling cable, the signal is given, and the train of logs, or turn, as it is called, moves down the road to the rollway, where the logs are rolled into the river and confined within a boom until they are floated to the mill. As soon as the logs are hauled in, the engine reverses and the haul-back line pulls the hauling cable back into the woods.

The method will be changed when the new logging railroad is completed. The engines will then haul directly to the railroad track, where the logs will be loaded on cars and taken to the mill. At present the logs are floated down the river to the mill at high tide. With the exception of Apitong, they all float well, but the danger from floods and lack of water in the dry season, as well as the constantly increasing distance of the forest from the river, make this method of transportation less satisfactory than a logging railroad, which can be built at a moderate cost.

The men employed in logging and their wages are as follows:

Americans (2):	
1 logging superintendent, per year	₱4, 200. 00
1 assistant.........per day..	4. 00
Filipinos (42):	
1 foreman....per day each..	1. 50
1 engineer...........do....	3. 00
1 engineer...........do....	1. 50
2 firemen............do....	. 50
1 subforeman.........do....	. 60
Filipinos (42)—Continued.	
4 fellers....per day each..	₱0. 65
6 buckers..........do....	. 50
7 cable men........do....	. 50
1 sled tender.......do....	. 50
4 woodcutters for the engines.....per day each..	. 50
4 road builders.....do....	. 50
10 water carriers for the engines.....per day each..	. 50

(₱2=$1 United States currency.)

This amounts to a daily labor cost of about ₱45. The logging crew handles on an average from 5,000 to 10,000 board feet of logs per day.

The above method, which has been employed since the commencement of the operations, is being supplemented by a railroad which is now being installed. The road is equipped with two locomotives and twelve logging trucks or cars. The gauge is 3½ feet. The donkey engines and cable system will continue to be used, but will haul the logs to the railroad track instead of to the river bank. This will give a great increase in the daily output of logs.

Waste and injury to the forest: The area thus far logged has been cut over without much restriction or regulation. About one-half of it has been burned over and is now partly under sugar cane. The remainder is slash as it has been left by the company. Since it is agricultural land, to a large extent homesteaded, it will not be managed for a second timber crop.

The trees cut have been almost entirely the six principal species, with an occasional large specimen of some other kind. Few trees less than 50 centimeters (20 inches) in diameter have been cut, and many larger ones have not been removed. The largest trees have been left because the mill could not handle them. On part of the area the Almon and White Lauans were not cut, because at the time there was no demand for that kind of lumber. The following table shows the number of saplings, poles, and trees remaining on one-half hectare of cut-over land. Many small trees are lacking which were destroyed but not utilized during the logging.

TABLE XIV.—*Saplings and trees remaining on one-half hectare (1.23 acres) of cut-over land.*

Size.	Apitong.	Almon.	Mangachapuy.	Balacbacan.	Dungula.	Ataata.	Guisocguisoc.	Other trees and shrubs.	Total.
Sapling	30	8	5	4	14	13	8	84	166
Small pole	5		4		8	1	2	8	28
Large pole	3				3	3	1	3	13
30 centimeters	1					1		1	3
35 centimeters	1								1
40 centimeters	1	1	2						4
45 centimeters			2						2
50 centimeters	2		1						3
55 centimeters			2					1	3
60 centimeters		1							1
115 centimeters			1						1
130 centimeters			1						1
Total	43	10	18	4	25	18	11	97	226

The logging makes a bad slashing. The tops and rotten logs of the large trees piled on the small trees crushed by their fall form a dense and almost hopeless mass of débris. Some of this is unavoidable, but care in felling the large trees and the utilization of as much of the timber as is possible will reduce the damage. Plates IX and X show pieces of good and bad slash. Fire in the cuttings during the dry months of March and April would be destructive to the young growth. Fire, however, does not run readily until the brush is thoroughly dry and the wind favorable. This condition obtains only for a few days in March and April. Sometimes the friction of moving logs upon the skids causes fires which might spread to the cuttings.

There is considerable waste in the felling and cutting up of trees. The Filipino fellers are usually not trustworthy and must be watched. Occasionally they leave stumps much higher than is necessary. High stumps can not be entirely avoided, because of the difficulty in sawing swell-butted logs in the present mill. With a new band-saw mill, capable of handling logs of any size, the stump height should be reduced. The average stump height of 23 Mangachapuy trees felled during the past year is 9 feet (2.8 meters) and of 13 Apitong trees 4.2 feet (1.3 meters). Apitong is much less buttressed than Mangachapuy and is a smaller tree. It is unreasonable at present to require that the large buttresses be chopped through in felling the trees, but it is practicable to cut at the point where the principal buttresses end. In cutting the trees into logs, it is difficult to determine when defective ones will repay handling. In cases of doubt the tendency is to leave them in the woods. Defective top logs are much more doubtful than butt logs, being knotty and diseased around the knots, which injures nearly all boards in the logs. However, when the company has gone to the expense of building a logging railroad and setting up donkey engines and cable, it is to their interest to remove every possible stick of timber from the area. Clear logs, not more than 50 per cent defective, should repay the cost of handling. They would also assist in bearing the expense of building roads.

Little sound saw material which is not excessively knotty is left in the tops. As a general rule, the trunks of fairly sound trees are utilized up to the large limbs. More than this is impracticable at present, as there is little sale for knotty lumber. Much of this material in the tops would make boxes. It may be found profitable for the company to manufacture box boards, in which case much timber now wasted could be utilized.

Another source of waste is the fuel used by the engines. This is usually secured from defective logs, which are hauled in and cut up into firewood. The tendency is to use logs which would be more valuable for lumber. Care should be taken to use no logs for this purpose which contain 50 per cent or more of good material.

A large number of trees are necessarily used for the construction of roads and bridges. One mile of hauling road requires over 100,000 feet B. M. for skids alone. Large amounts in the future will be necessary for ties, bridge timbers, etc. At present, Apitong, Ata-ata, and small trees of the principal species are used. Unmarketable trees and tops of felled trees, as far as possible, should be used for construction work, except on land which is to be cleared for agriculture, where small trees of all kinds can be used.

Logging does injury to the small trees and reproduction, which are to be the basis of the future forest. The large and overmature trees should be cut out to give the young growth an opportunity to take their places. Consequently, the logging must not destroy more than is necessary of the small growth. Much of this damage is unavoidable. The fellers, however, can be shown how to drop the trees where the damage will be least.

The sawmill: The present sawmill is located on the right bank of the Himugaan River, about 6 miles from its mouth and about 1 mile north of the logging operation, which is on the opposite side of the river. The location is at the head of navigation for small steamers, although high tide reaches nearly 2 miles farther up. The mill stands on the river bank, jutting slightly over the water. (Pls. XI and XII.) From the mill a short tramroad runs to the lumber yard, directly in front of which is the dock. (Pl. XI.) Surrounding the yards are the office and quarters of the employees. The mill is operated by a steam engine and is equipped with a circular saw, a top saw, a simple edger and trimmer, and a saw-filing machine.

The logs are boomed just below the mill in the river and are brought up into the mill by a bull wheel and cable. They are then rolled on to the carriage by a chain and drum operated by the engine. The carriage is run by friction feed. The logs are sawn slowly and carefully. The sawn lumber passes to the edger on dead rollers, is lifted by men to the trimmers and from there to the truck, which bears it to the yard. The principal species cut present no great difficulties in sawing. Apitong is much harder on the saws than the others. The waste is large, owing not only to the defective character of the timber but also to the inadequacy of the mill and the unskilled labor at the edger and trimmer. The standard length of logs is 16 feet, but some 12, 14, and 18 foot logs are cut. The lumber is cut mostly in 1 and 2 inch thicknesses, with some 2 by 4's and special sizes. It is piled in the yard without cover other than a few boards, and without grading except by species and thickness. Most of it is shipped green to Manila, as the demand is greater than the supply. It is all clear lumber, and with careful grading and seasoning its quality would be much improved. The mill has been subject to some shut downs, owing to floods, breakage, and lack of logs. The following is the average operating pay roll at the sawmill:

Americans (3):	
1 sawyer........per year..	₱4,000.00
1 bookkeeper. per month..	150.00
1 setter...........per day..	4.00
Filipinos (28):	
1 dogger....per day each..	1.00
1 dogger............. do....	.65
1 engineer ....do....	2.00
1 fireman............do....	.60
1 fireman's helper...do....	.50
1 offbearer ....do....	.50
1 offbearer's helper .do....	.50
2 men sawing logs in the water.... per day each..	.50
Filipinos (28)—Continued.	
2 men hauling logs into mill, per day each............	₱0.50
2 edgers....per day each ..	.75
2 trimmers...........do....	.50
2 men loading trucks, per day each	.50
1 man removing sawdust, per day each	.50
8 yard men, per day each..	.50
2 watchmen, per month each	15.00

₱2=$1 United States currency.

This is a daily labor cost of about ₱42.

Cost of lumbering: The estimated cost of logging and manufacturing lumber on this tract is only approximate and is intended as an indication of what can reasonably be expected under fair management.

The following is the cost per 1,000 feet B. M. of the lumber delivered in Manila, including deterioration, repairs, and interest on the investment at 10 per cent:

Cutting and hauling logs to the river	₱7.00
Floating logs to the mill	.30
Sawing and piling in the yards	6.00
Loading on barges at the dock	.40
Freight to Manila (about 400 miles)	10.00
Lighterage in Manila	2.00
Salaries of higher officials	9.00
Average Government charge, or stumpage	2.50
Total	37.20

It is certain that with a thoroughly modern mill and a logging railroad, which the company is now putting in, the cost per 1,000 feet will be reduced much below the above figure. Perhaps the pay rolls given above and the freight and Government stumpage charge will indicate better to lumbermen what the cost should be.

Markets and transportation: The markets for the lumber are the cities of Manila, Cebu, and Iloilo. The distance by water to Manila is about 400 statute miles, to Cebu about 140 miles, and to Iloilo about 70 miles. Very little lumber can be sold locally or outside of those towns. Manila is the chief market. In the past two years the company has sold about 1,300,000 feet B. M. of timber in Manila, 190,000 feet B. M. in Cebu, and 275,000 feet B. M. in Iloilo. About 7,300 feet B. M. only were sold to local consumers. At the beginning there was difficulty in selling large shipments of lumber because of the prejudice against Lauan. The demand has slowly increased until now what is known as Red Lauan is taken in large quantities, and the White Lauan finds a fair sale. Its principal competitor is Oregon Pine, which is about equally good for most purposes, and sells in Manila for about ₱75 per 1,000 feet B. M. The Insular Lumber Company should be able to manufacture their lumber and deliver it in Manila at a price which would gradually drive out the Oregon Pine. Manila would at the present time use 100,000 feet B. M. per day if it were available. It is possible that some of the clearest and best Balacbacan and Red Lauan can be exported, possibly to the United States. A small lot was shipped to New York, where it was received with favor.

Transportation of lumber is by water. Freight to Manila in barges (Pl. XI) towed by a small steamer is ₱10 per 1,000 feet B. M. To Iloilo and Cebu in lorchas the freight rate is about the same.

Prices and government charges: In the Philippine Islands the government charges for timber are usually levied on round logs. For timber cut in the province of Negros Occidental they are ₱2.50 per cubic meter for first-group timber, ₱1.50 for second group, ₱1 for third group, and ₱0.50 for fourth group, which is equivalent to about ₱10, ₱6, ₱4, and ₱2, respectively, per 1,000 feet B. M. In the license agreement with the Insular Lumber Company, however, provision is made that the charges be paid on the sawn lumber, plus 15 per cent for loss in sawing. Since the loss in sawing is more than 15 per cent, the company has profited by the arrangement, as is shown by the following figures of cost per 1,000 feet B. M. of the sawn lumber. The timber cut by the Insular Lumber Company is almost exclusively of the third and fourth group. In the fiscal year 1904–5 they paid an average price of ₱0.64 per cubic meter, or ₱1.76 per 1,000 feet B. M., and in 1905–6 ₱0.87 per cubic meter, or ₱2.37 per 1,000 feet B. M. As the company receives on an average of more than ₱60 per 1,000 feet B. M. for their lumber in Manila, the above stumpage charges are low.

Prospects: It is apparent from the above that a modern lumber enterprise on this tract ought to be successful. Believing this, the Insular Lumber Company is now increasing its equipment and making improvements. A new modern double mill is being built, which will have a capacity of 100,000 feet B. M. per day. It will be equipped with a 9-foot wheel and 13-inch band saws. The logging railroad is already completed from the mill to the timber and will soon be in operation. The company is ready to install a tie-impregnating plant just as soon as it can make contracts with the new railroads to take the output. Profiting by the experience of the past two years, the company will put capable men in charge and will use every effort to make the operation as efficient as any similar one in the United States. Rightly conducted, the enterprise should pay a handsome profit, at the same time furnishing lumber to the people of the islands at prices lower than that of Oregon Pine. The railroad, which will soon be built with government aid in Negros Occidental from Escalante to Binalbagan or Ilog, will pass close to this tract, if it does not go through its lower side. The new railroad will naturally benefit the Insular Lumber Company by furnishing a market for railroad ties and construction timber and by making available the local markets of the province of Negros Occidental.

MINOR FOREST PRODUCTS.

Various minor forest products are collected on the tract by the inhabitants of this region. Chief of these is bejucó (rattan), which occurs throughout the concession. It is now rather scarce near the edge of the forest and in the more accessible parts of the tract, owing to the long-continued custom of collecting this product. To obtain good bejuco, it is now necessary to go 5 to 10 miles into the forest, although small specimens are abundant everywhere. The demand for the bejuco is strong in the sugar haciendas and towns of Negros, where its principal use is for tying up sacks of sugar. The prices are such as repay the collector, who usually builds a house in a good situation in the forest, and with the help of a few natives, Visayans or Negritos, collects the bejucos, putting them up in small bundles of 100 pieces, ten of which form large bundles, which are then carried out by men or carabaos. Three such camps were found on the tract. In addition, many persons enter the tract for a day or two to take bejuco for their personal use. The best bejucos on the tract are Gatasan, Yaming, Lontoc, and Calape. Split bejucos, used in tying up sacks of sugar, are worth ₱1.50 per 1,000; entire bejucos, 8 meters long, used in binding rafts, ₱15 per 100. Long bejucos for special purposes bring high prices.

Balao, the pitch obtained from the Apitong tree by a destructive system of boxing, heretofore described, has for some years been collected on the tract. It is a dirty-gray pitch, used locally to make torches and commercially to calk boats. Its value in Cadiz is from ₱0.50 to ₱0.75 per 5-gallon can. It is doubtful if one tree yields more than one such can per year under the present method of collecting. The product does not compensate for the damage done to the tree. Until a less injurious method of tapping the Apitong is devised, the collection of balao on the tract should be prohibited.

Two vines, Jagnaya and Sigid, which are collected to a limited extent, occur on the tract. They are small, about 1 centimeter in diameter, long, and very strong. They are used almost exclusively in the construction of fish corrals, and are worth in Cadiz from ₱0.60 to ₱0.70 per 1,000.

The firewood possibilities of the concession at present are small. Neighboring sugar haciendas use considerable wood for fuel, but prefer to get it from the mangrove swamps, or, if from the mountain forest, to cut it themselves. Neither is it probable that firewood cut on the tract can be shipped to the large towns of the islands in competition with the mangrove product.

The forest has few other minor products. There are scattered trees which yield gums and resins, but none of them occur in sufficient numbers to be of any commercial importance.

Minor products are not included in the concession granted to the Insular Lumber Company. With the exception of balao, they can best be utilized in satisfying the needs of the surrounding population. Consequently, no special recommendations are made for the regulation of their collection.

AGRICULTURAL POSSIBILILIES OF THE LAND.

Cleared land adjoining the tract, which has the same soil and general characteristics of the more level parts of the forest, is giving good results in agriculture. Sugar cane, hemp, and corn are the principal crops, all of which do well, although the sugar made from cane grown on this soil is discolored, and does not bring the best prices. For sugar cane the land is called third class. Corn grows well, and is the chief product of the poor people. At the present the price of the land is low. Probably considerable areas now covered by cogon grass and brush can be bought at less than ₱20 per hectare.

There are many acres of land on the tract suitable for corn, and a smaller area would give good results in sugar cane. About 300 acres in the northwest corner and in the valley of the Himugaan River are now under cultivation. The exact area of the tract which is better for agricultural uses after being lumbered is not definitely known. There are probably about 10,000 acres which would be classed as agricultural land, of which about 4,500 acres are either cleared or covered with brush. The largest single area of good agricultural land is in block 7, east of the Himugaan River. All of such land is confined to the northern side of the tract. The upper hilly portion is more valuable for forest than for agricultural purposes.

There is a strong desire for the land among the neighboring people. Often, however, they use poor judgment in selecting their clearings, choosing rough, stony places, when rich level land is available. Land suitable for agriculture should be given to the people for homesteads after it has been logged by the company.

PART II.

FUTURE MANAGEMENT.

BASIS OF PROPOSALS.

RELATION BETWEEN OWNER AND LICENSEE.

The owner of this tract of timber land is the government of the Philippine Islands. In order to secure a revenue from the heavy stand of timber which is balanced between growth and decay, a license agreement was made with the Insular Lumber Company, permitting that company, under restrictions, to exploit timber on the tract for a period of twenty years. The government requires that this be done without endangering the future supply of timber from the same forests, unless the land is more suitable for agricultural than for forest purposes, in which case the most benefit will be derived from its use for agriculture. On agricultural land the company should remove the greatest possible amount of merchantable timber before it is turned over to the farmer. On true forest land, which includes most of the tract, they should leave a sufficient number of trees to provide for the future stand and exercise care in the logging in order to prevent the destruction of an unnecessary amount of reproduction and small trees.

The company, on the other hand, must make their enterprise yield a considerable profit in order to repay them for the risk in establishing a modern lumbering operation in a tropical country, where there is no experience of others to assist them in avoiding disastrous mistakes. They have invested a large capital in the enterprise, setting an admirable example for those contemplating entering the lumber business in the Philippine Islands. Consequently many sylvic restrictions suitable and beneficial to the forest can not be imposed without excessive hardship to the company. The restrictions and regulations should be practicable, with due regard for the interests of both the government and the licensee.

DIVISION OF THE FOREST INTO BLOCKS.

To facilitate the management and protection of the forest, and to make the description of places on the tract more concise and definite, the tract is divided into eight parts or blocks, which are bounded by the important streams. They are shown on the map and described as follows:

TABLE XV.—*Description of blocks.*

Block.	Situation.	Approximate area.		Remarks.
		Hectares.	Acres.	
1	Southwest corner of the tract between the Talabon River and the boundary.	1,400	3,450	Hilly land; all heavily timbered.
2	Between the Hitalon and Talabon rivers.	1,800	4,450	Rolling and hilly land; considerable area of grass and brush land; contains barrio of Mabini.
3	Between the Panicion and Hitalon rivers.	2,100	5,150	Rolling and hilly land, mostly heavily timbered; some agricultural land.
4	Between the Pioc and Himugaan rivers on the east and the Panicion River on the west.	1,600	3,950	Rolling and hilly upland and some bottom land; clearings, cultivated land, and present cutting area near Himugaan River.
5	Between the Iglumgum and the Malugo rivers on the east and the Pioc River on the west.	1,200	2,950	Rolling and hilly land, mostly heavily timbered; little agricultural land.
6	Between the Himugaan and the Iglumgum rivers.	3,600	8,890	Do.
7	Between the Tanao and Himugaan rivers.	4,400	10,850	Rolling and hilly land, heavily timbered; large area of agricultural land.
8	East end of the tract between the boundary and the Tanao River.	1,900	4,700	Rolling and hilly land, heavily timbered.
	Total	18,000	44,390	

These blocks will furnish a useful basis for future investigations on the tract. The logging operations will probably be confined to blocks 3, 4, and 6 for several years, and consequently should receive as soon as possible a more careful and detailed study than has yet been given to them.

The principal trails in the forest have been surveyed and marks have been placed on them every one-half kilometer from their starting points. Each trail is given a letter—for example, 2 KC means that the mark is on Trail C, 2 kilometers from its beginning. The trails and their marks are on the forest maps. Places in the forest can be located easily and definitely. If a clump of large Apitong trees is discovered, one will pace to the nearest trail, down the trail to the first survey mark, and will then describe the location of the Apitong as follows: Block 4, B. F. 3 KC., S. W. 200 m., S. E. 300 m. The place is then definitely located with few words and can be marked accurately on the forest map. This method of description will be used by forest officers for future work on the tract.

SUMMARY OF MERCHANTABLE STAND AND YIELD.

The following is a summary of the number of merchantable trees and of the merchantable yield of the six principal species above 40 centimeters (16 inches) and 50 centimeters (20 inches) in diameter, respectively:

Diameter.	Stand.		Yield.	
	Number of trees per acre.	Number of trees per hectare.	Feet, board measure, per acre.	Cubic meters per hectare.
40 centimeters	29.4	72.6	33,450	288.5
50 centimeters	22.3	55.1	32,050	265.9

METHOD OF TREATMENT.

OBJECT TO BE ATTAINED.

The object to be attained is to make the best use of the land and forest by securing the largest possible yield from the latter without inflicting hardship upon the licensee or endangering a future timber crop on the forest land, and by putting the agricultural land to its best use.

METHOD OF TREATMENT ADOPTED.

It is evident that agricultural and nonagricultural lands must receive different treatment. The former will be turned over to the farmer after being logged; the latter will be kept in forest to provide for a future yield.

Agricultural land now covered with merchantable forest will be treated as nearly as possible under a clear cutting system—that is, all merchantable trees will be cut for lumber and as many of the unmerchantable trees as possible for road construction. No care need be taken to protect the reproduction, as the land will be immediately cleared for agriculture. The essential requirement is that no merchantable timber be left on the land. As the logging proceeds, the boundaries of the agricultural land must be determined.

Nonagricultural or forest land will be treated under the selection system, with a continuous yield of the six principal species in view. Care must be taken to leave sufficient small trees and reproduction to provide for the future yield. No provision is advisable at present for a regular rotation and sustained annual yield.

EXPLOITABLE SIZE.

On agricultural land, all trees are exploitable.

On forest land, none of the six principal species must be cut below a certain diameter limit. The diameter limit must be fixed so there will be sufficient seed trees and young growth to secure a good stand of the desired species. There should be as many trees as possible left standing without seriously affecting the merchantable yield. With a diameter limit of 40 centimeters (16 inches) there is a yield of about 33,450 feet B. M. per acre, leaving 28.1 trees per acre 12 to 40 centimeters in diameter. With a diameter limit of 50 centimeters (20 inches), there is a yield of about 32,050 feet B. M. per acre, leaving 35.3 small trees per acre 12 to 50 centimeters in diameter. Cutting to a 50-centimeter limit instead of to a 40-centimeter limit, there is a loss in yield of 1,400 feet B. M. per acre, or 4 per cent, and a gain in small trees of 7.2 per acre, or 25 per cent. The 50-centimeter diameter limit is clearly the better. Moreover, trees below 40 centimeters in diameter would probably not seed well, while trees between 40 and 50 centimeters in diameter would produce considerable seed under the influence of increased light and space. Since a part of the small growth is unavoidably destroyed by the logging, it is all the more necessary to fix the diameter limit higher than 40 centimeters. The company has, however, shown little desire to exploit the trees between 40 and 50 centimeters in diameter, using them only in road construction. Therefore, a 50-centimeter diameter limit will be found practicable. Whether it is sufficiently high to provide for a satisfactory second crop is not certain. It is proposed as a provisional diameter limit until that fact is learned.

THE LOGGING.

Cutting areas.—The areas chosen by the company for exploitation should be selected with the approval of the Bureau of Forestry, to avoid leaving uncut exposed strips of forest. The cutting should proceed as regularly and compactly as possible. It is not deemed advisable, in view of the condition of the forest and other factors, to place any restrictions upon the size of the annual cutting area.

General cutting rules.—The following cutting rules shall apply to both agricultural and forest lands.

(1) All felling and cutting shall be done with saws as far as possible.

(2) No trees shall be left lodged in the process of felling.

(3) No stumps shall be higher than the principal buttresses.

(4) Defective logs containing 50 per cent or more clear, sound lumber shall be utilized for lumber.

(5) No logs containing 50 per cent or more clear, sound lumber shall be used as fuel for the engines.

(6) No sound logs in the tops of the trees 8 feet and over in length and over 15 inches in diameter shall be left in the woods.

(7) Excessive quantities of timber cut for construction purposes in the forest and wasted shall be manifested and paid for by the company.

(8) Timber wasted in violation of the cutting rules shall be measured by the forest officers and paid for by the company.

Additional cutting rules for agricultural land.—(1) Agricultural land shall, as far as possible, be the first to be logged.

(2) All merchantable trees of the six principal species 40 centimeters (16 inches) and over in diameter shall be cut for lumber.

(3) For construction purposes in logging, trees of the minor species and unmerchantable trees of the principal species only shall be used.

(4) Small trees broken down by the large trees in felling shall be utilized.

(5) The railroad ties and skids for use in logging on the forest land shall be taken from the agricultural land whenever possible.

Additional cutting rules for forest land.—(1) No Apitong, Almon, Balacbacan, Mangachapuy, Lauan-bagtican, or Lauan-dunlog trees less than 50 centimeters (20 inches) in diameter shall be cut unless they stand in a proposed road, interfering with the logging, unless they have been damaged by the logging, or unless they have been selected for felling by the forester in charge of the district.

(2) No Apitong, Almon, Balacbacan, Mangachapuy, Lauan-bagtican, or Lauan-dunlog trees less than 50 centimeters (20 inches) in diameter shall be used in road or bridge construction unless they stand in a place interfering with the logging, where their removal is necessary.

(3) The workmen must not destroy seedlings or saplings of Apitong, Almon, Balacbacan, Mangachapuy, Lauan-bagtican, and Lauan-dunlog.

(4) Care must be taken to prevent fires on the cut-over land during the dry season.

SUPPLEMENTARY RECOMMENDATIONS.

GENERAL MANAGEMENT.

(1) The forest adjoining the tract on the north, which is especially liable to destruction by caiñgins, should be logged as soon as possible by the company under yearly license.

(2) The areas to be logged shall be selected by the company, after securing the approval of the bureau of forestry.

(3) Cut-over land suitable for agriculture shall be immediately opened to homestead entry.

(4) The boxing or tapping of the Apitong tree for balao shall be prohibited on the tract.

(5) The species of timber manufactured by the company shall be classified in the timber groups to which they properly belong as soon as possible.

(6) The company shall sell manufactured lumber to the residents of the municipalities of Cadiz, Sagay, and Escalante at prices which shall never exceed the wholesale price in Manila, less freight and lighterage.

(7) A ranger employed by the bureau of forestry shall be stationed permanently on the concession, whose duties shall be to protect the forest from caiñgins and trespass, to inspect the lumbering operations, and to make forest investigations under the direction of the chief of the forest district.

(8) The stumpage charges will continue to be paid on the manufactured lumber.

PROTECTION.

In order to put the above plan into effect, the forest must be protected before as well as after it is logged. The destruction of standing timber is a loss to the Government as well as to the company, but the loss to the latter is more serious, since such destruction is here confined to the most accessible part of the tract, where the profits from lumbering are correspondingly greater. The production of the future timber crop can not be provided for without protection of the forest, nor can sylvic restrictions be imposed on the company. The necessity and difficulty of protection against caiñgins have been shown in Part I. The benefits of protection being mutual, the company should cooperate with the bureau of forestry in carrying out the necessary measures.

The problem is to prevent the caiñgins, because after the damage is done there is no remedy. The following measures are necessary:

(1) The ranger of the bureau of forestry stationed on the concession shall engage himself principally with its protection.

(2) The company shall provide him with the necessary assistance to make his work effective.

(3) The ranger shall patrol the concession thoroughly and prevent caiñgins by means of warnings, and arrests if necessary.

(4) The northern boundary of the tract shall be surveyed and marked. Every one-half kilometer a painted board marked with the letters B. F. and the number of kilometers from the starting point should be nailed to a tree. Where trails cross the boundary, warning notices in the Visayan dialect should be posted, stating that caiñgins are prohibited on the tract and that permission to collect forest products must be obtained from the ranger in charge.

(5) The cleared lands within the tract bordering on or surrounded by forest shall be surveyed and marked in order to prevent their extension.

(6) Residents of the towns within which the tract is situated who desire to collect forest products for personal use shall obtain a written permission from the ranger in charge. Permission should be granted in all such cases, except for balao.

It is believed that the above measures are practicable and will in a short time bring the caiñgins under control.

REVISION.

This is a preliminary working plan, therefore it will naturally be found inadequate in many ways, and shall be amended from time to time.

ADMINISTRATION.

The forest officers who shall be charged with the administration of the plan shall be the forester in charge of district No. 8 and the ranger stationed permanently on the tract. Action taken by them to enforce the provisions of the plan shall be reported to the director of forestry for approval.

The forester in charge of district No. 8 shall have general supervision of the tract and shall make frequent inspections. The ranger stationed on the tract shall have immediate supervision, under the direction of the forester. In matters relating to the protection of the forest from fires and trespass, he shall take the necessary action, promptly reporting the facts to the forester. In matters concerning the compliance of the Insular Lumber Company with the provisions of the working plan, the ranger shall note the facts and report them to the forester. The forester will investigate and, if possible, arrange the matter with the representatives of the company, reporting the results to the director of forestry. New regulations and amendments to existing regulations shall be recommended by the forester to the director of forestry. The forest officers shall assist the company with information regarding the tract, which they have collected in their investigations. Every effort consistent with the wise use of the forest products on the tract should be made by the forest officers to assist the company in making this enterprise a financial success.

The sections relating to cutting rules, management, and administration have been submitted by the director of forestry to the Insular Lumber Company for suggestions, and after a discussion of a few features of the working plan, the sections mentioned were, after slight modifications, agreed upon.

APPENDIX.

LIST OF TREE SPECIES.

The following is a list of tree species mentioned in the text and includes, among others, all the commercial species found in merchantable quantities. Botanical specimens of about seventy tree species were collected. While the data at hand is too incomplete to make an estimate of the total number of tree species on the area, yet compared with other forests in the Philippines already examined, this one has a comparatively simple floristic composition. On the other hand, contrasted with the average hardwood forest of the Temperate Zone, it is more complex. It will be seen from the stand and yield tables that the six species of *Dipterocarpaceæ* are so far ahead of all others, both in number of trees and bulk of wood, that this may be regarded as a pure Dipterocarp forest. From a lumberman's standpoint, the yield of timber in this forest is equal to, or exceeds, the best American hardwood forest, and compares favorably with the best coniferous forests of the eastern United States.

At present there is much confusion among the commercial timbers in the Philippines which can not be avoided until more is known about them. A number of species are placed on the market under one name, and sometimes the same species has several different market names. For the sake of comparison, the fourth column of the list gives the known names under which the species are sold in the Manila market.

The authors wish to express their thanks to Elmer D. Merrill, botanist, bureau of science, for assistance in the identification of the botanical material.

List of the species mentioned in the text.

Scientific name.	Family.	Local common name.	Commercial name.
Astronia cumingiana Vid	Melastomaceæ		
Breynia rhamnoides Muell-Arg	Euphorbiaceæ	Tulug-tulug	
Canarium sp	Burseraceæ	Moabog	
Diospyros sp	Ebenaceæ	Ata-ata	Bolongeta.
Dipterocarpus grandiflorus Blanco	Dipterocarpaceæ	Apitong	Apitong.
Eugenia sp	Myrtaceæ	Bulog	
Ficus hauili Blanco	Moraceæ	Labnug	
Homalanthus populneus Pax	Euphorbiaceæ	Balanti	
Hopea philippinensis Dyer	Dipterocarpaceæ	Guisoc-guisoc	
Kayea sp	Guttiferæ		
Livistona sp	Palmæ	Anahao	Palma brava.
Mallotus ricinoides Muell-Arg	Euphorbiaceæ	Himlaamo	
Oncosperma sp	Palmæ		
Pandanus sp	Pandanaceæ	Pandan	
Pinanga sp	Palmæ		
Psidium guayava L	Myrtaceæ	Bayabas	
Shorea contorta Vid	Dipterocarpaceæ	Lauan-dunlog	White Lauan.
Shorea polysperma Merr	do	Balacbacan	Balacbacan, Tanguile, Red Lauan.
Shorea sp	do	Mangachapuy	Red Lauan, Balacbacan.
Do	do	Lauan-bagtican	White Lauan.
Shorea squamata Dyer	do	Almon	Do.
Trema amboinensis Blume	Tiliaceæ	Janagdon	
Vitex aherniana Merr	Verbenaceæ	Dungula	Sasalit.

BUREAU OF FORESTRY.

(Bulletin No. 6.)

A PRELIMINARY WORKING PLAN FOR THE PUBLIC FOREST TRACT OF THE MINDORO LUMBER AND LOGGING COMPANY, BONGABON, MINDORO, P. I.[a]

By Melvin L. Merritt, *forester, in charge of forest district No. 5,* and H. N. Whitford, Ph. D. *forester, chief of the division of forest products.*

LETTER OF TRANSMITTAL.

Manila, *November 5, 1906.*

Sir: I have the honor to submit herewith a manuscript entitled "A Preliminary Working Plan for the Public Forest Tract of the Mindoro Lumber and Logging Company, Bongabon, Mindoro, P. I.," by Melvin L. Merritt, forester, in charge of forest district No. 5, and H. N. Whitford, Ph. D., forester, chief of the division of forest products, and respectfully recommend its publication as Bulletin No. 6.

Very respectfully,

George P. Ahern,
Director of Forestry.

The Acting Secretary of the Interior, *Manila, P. I.*

A PRELIMINARY WORKING PLAN FOR THE PUBLIC FOREST TRACT OF THE MINDORO LUMBER AND LOGGING COMPANY, BONGABON RIVER, MINDORO, P. I.

INTRODUCTION.

The territory with which this report deals is held under a twenty-year license agreement by the Mindoro Lumber and Logging Company. This agreement, dated July 3, 1905, gives it "exclusive right to cut, collect, and remove timber, firewood, and bejuco" from the part of the public forest later described, on the condition that it complies with the rules and regulations of the bureau of forestry in cutting, collecting, and removing said forest products.

The work upon which this report is based was undertaken for the purpose of forming a preliminary plan of management to be put into operation, pending more complete investigation. Hence the present plan must be looked upon merely as provisional and subject to change when more definite information is obtained.

The field work was done by a party consisting of two foresters, one assistant forester, two native rangers, and from two to nine native laborers, working for a period of over four months. The tract was inspected, surveyed, and mapped, and notes were taken on the distribution of the different types of vegetation. Valuation surveys were then made over approximately 2 per cent of the better part of the forest. The trees were calipered and listed on strips 10 meters wide along lines 500 meters apart. Owing to the poor condition of the rest of the forest, and to lack of time, the remainder of the tract was investigated more hurriedly. While engaged in this survey an extensive botanical collection was made, which is the basis of the scientific nomenclature of this paper.

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[a] The following illustrations accompanying this report have been omitted and are on file in the War Department:

Plate I. Interior view of the Hagachac forest. II. General view of the Narra forest type. III. Interior view of a Narra forest. IV. View of the beach forest type. V. Agoho growing along the Bongabon River. VI. View of a Calaanan forest. VII. Interior view of a Mangrove swamp. VIII. Narra. IX. Stump of Narra. X. Hagachac. XI. A young tree of Lauan. XII. Reproduction of Lauan. XIII. A young tree of Guijo. XIV. Apitong.

Map of public forest tract between the Sucol and Uasig rivers, Mindoro, P. I., operated under a twenty-year license agreement by the Mindoro Lumber and Logging Company.

PART I.

STATEMENT OF THE FACTS UPON WHICH THE WORKING PLAN IS BASED.

GENERAL DESCRIPTION OF THE TRACT.

SITUATION AND AREA.

The tract of land examined lies upon the east coast of the island of Mindoro, just north of the twelfth parallel of north latitude and east of the one hundred and twenty-first meridian east of Greenwich. The whole tract contains an area of about 85 square miles, while the part surveyed and examined includes approximately 55 square miles.

BOUNDARIES.

According to the terms of the license agreement, the tract is bounded as follows: "From the Sucol River south to the Uasig River, and 10 miles inland." Upon ascending the Sucol River it was found that the native name is changed to Inuman after a short distance, therefore this river has been taken as the north boundary. A short distance inland the Uasig River divides into two branches, a large one known as the Baroc, and a small, nearly dry stream called the Uasig. No investigations were made south of the Baroc branch.

PHYSIOGRAPHY.

As may be seen on the map, the part examined is more or less triangular in shape, having its broadest side toward the coast. Starting at sea level, the land rises slowly and evenly as a broad, flat plain until about 7 miles (11 kilometers) inland it reaches an altitude of nearly 30 meters (100 feet). Here are found a few scattering hills, although the country is still quite level for a short distance more, especially along the Bongabon River. Back from this flat the foothills rise quickly into the broad and high mountain chain which runs north and south through Mindoro. To the south of the tract the foothills extend almost to the coast. To the north a low and less clearly defined range of hills reach nearly to the beach at a point about 4 miles north of the Sucol River.

The whole territory is drained mainly by the Bongabon, Dangay, and Uasig rivers, all of which have rapid currents. The Bongabon River is the largest of these and flows through a grassy flood plain about half a mile wide. During the wet season this valley is often flooded and the river is practically impassible. At such times there is an abundance of water for rafting, but the rapid current, which extends far out to sea, would necessitate very strong booms at the mouth of the river to stop logs. The Dangay and Uasig rivers are smaller and flow through tidal swamps which check their currents. The former could probably be utilized for floating logs for a short distance from its mouth. The Uasig (Baroc) River could also be used in this way a long distance into the interior during the heavy rains, as the river bed is quite free from obstructions.

GEOLOGICAL FORMATION AND SOIL.

The entire flat is probably of delta origin, having been formed by the action of the Bongabon River. During this formative period there were a number of uplifts that have changed the shore line and the river course from time to time, resulting in the origin of different physiographic units. Corresponding to these there are distinct vegetative types which are adapted to the physical conditions of the topographic units upon which they are found.

The soil is, in general, a deep, fine clay, covered with a thin layer of humus. No underlying rock was found on the flats, although examinations were made in many places from 1 to 2 meters in depth. In the valley of the Bayangan River there is a subsoil of sand or sandy gravel at a depth of from 75 centimeters (30 inches) to 150 centimeters (59 inches) which appears to be more or less continuous. A more shallow sandy subsoil was also found north of the Bongabon River on the grassy and poorly wooded flats. In almost all places the soil is rich and suitable for agriculture.

CLIMATE.

Formerly no records either of rainfall or temperature had been taken in Mindoro. The rainfall, however, is heavy and more or less distributed throughout the year. The period of heaviest rain comes during the months of July, August, September, and October, while the lightest is during January, February, March, and April. Notes regarding the rainfall, which were kept from January 16 to March 31, show the following number of rainy days:

Date.	Number of days with heavy rainfall.	Number of days with light rainfall.	Date.	Number of days with heavy rainfall.	Number of days with light rainfall.
January 16 to 31	2	5	March 1 to 14	3	6
February 1 to 14	0	1	March 15 to 31	0	4
February 15 to 28	0	0			

The coolest months are from September to February and the warmest from March to June. Although the warmest months are normally the driest, the northeast monsoon which prevails at this season brings some rain and moderates the heat.

ROADS AND TRAILS.

Extending from the beach just south of the Cauayan River to the sawmill of the company, about 1½ miles inland, there is a logging tramway, made with wooden rails laid upon cross-ties. Aside from this one tramroad there are only rude trails running through the tract. Nearly all of these are passable for horses or carabaos, although some are merely footpaths through the woods. With the exception of a few rude structures, made only for foot passengers, there are no bridges on the tract.

None of the present trails would be of any value in lumbering except for the passage of laborers and carabaos. All logging roads must be built especially for that purpose. This, however, is easily done outside of the swamps, it only being necessary to clear away the brush and small trees. All such roads are good during the dry and many of them fairly good in the wet season.

SOCIAL AND ECONOMIC CONDITIONS.

According to the last census report, the tract which includes the barrios of Anilao, Masaguisi, and Paclasan supports a population of about 650. In addition, the barrios of Bongabon to the north and Uasig to the south, which have a combined population of nearly 450, draw approximately half of their support from the tract. The people live in or near villages, around which they practice a rude agriculture, the crops being corn, rice, and vegetables. The only landowners in this territory claiming more than a few acres are a Filipino, who pastures about 300 head of cattle near Paclasan, and an American at the sitio Cupang, who has planted several thousand hemp and cocoanut plants. The Filipinos depend for their forest products upon the forest adjacent to the settlements. They gather resin for torches from Pili and Pagsahiñgin trees, a limited amount of Buri palm leaves for mats, Nipa palm leaves for thatching, and bejucos for rope. The mangrove swamps furnish the firewood, and not much timber is used locally. For the most part these and other needs may be supplied without affecting the virgin forest.

OWNERSHIP OF THE LAND.

Practically all of the second growth and grass lands within a distance of about 2 miles from the coast are claimed by private persons. There are also a number of holdings farther back. None of these have titles. although some have Spanish titles. Practically all of the commercial and uncut noncommercial forest and swamp lands are parts of the public domain. Owing to the fact that no land surveys have been made, it was deemed impracticable to attempt to separate the public from the private lands except in this general way.

COMPOSITION AND CONDITION OF THE FOREST.

CHARACTERISTIC TYPES.

Several distinct natural and artificial types of vegetation are found, due principally to—

First. The influence of salt water.
Second. The effect of drainage.
Third. The action of rivers.
Fourth. Fire.
Fifth. The clearing of forests by man.
Sixth. The sylvicultural demands of the different species.

The effect of these factors will be noted as each type is discussed, both for the purpose of showing why that type is present and in order to indicate its possibilities for future development.

Since the vegetation of one type merges gradually into that of another, it has been impossible to fix the boundaries exactly and to locate the areas definitely on the map. The following is the classification, with the estimated per cent, of each type for the portion of the tract surveyed:

	Per cent.
Commercial forest areas:	
Narra type	10
Hagachac type	15
Mixed type	12
Beach type	1
Total commercial forest	38
Noncommercial forest areas:	
Guipa type	8
Calaanan type	19
Unclassified	7
Total noncommercial forest	34
Swamp forest areas:	
Mangrove and Nipa types	11
Buri type	2
Total swamp forest	13
Other areas:	
Grass land	13
Cultivated land	2
Total	15

COMMERCIAL FORESTS.

Narra type.—Most important of all the different types of forest is that in which Narra (*Pterocarpus indicus* Willd.) grows as the characteristic tree. This type extends from the swamp belt near the coast back over the newly made and poorly drained flats until it reaches a higher and better drained soil, where it gradually disappears. Over this tract the abundance of soil moisture and the comparatively open character of the forest furnish the conditions in which Narra reaches its best development.

The general appearance of the forest is much the same throughout. (Pls. II and III.) Usually there are twelve to fifteen large and tall-growing trees of perhaps half as many species scattered over an acre. These form a broken upper story to the forest. Scattered in among them are a great many smaller and lower-growing or younger trees that fill in the ground space, making a thick under story. Of the smaller trees there are from fifty to seventy species commonly reaching a size of over 10 centimeters (4 inches) in diameter when mature. In addition, there are many that do not reach this size.

Mixed with this lower growth, though often shooting up to greater heights, are numerous palms (Pl. II), while throughout the whole is a mass of climbing bamboo, bejuco (rattan), and other vines that extend to the tops of the tallest trees, as well as over the growth lower down, and often forms dense tangles on or near the ground. Herbs and shrubs are relatively unimportant. Taken as a whole, the undergrowth of brush and vines, especially bejuco, is so thick that in walking through the forest it is necessary to use a "bolo" to cut one's way.

Principal species: Of the trees reaching a diameter of over 40 centimeters (16 inches), Narra constitutes 7.16 per cent. Other timber trees are Lauan (*Shorea contorta* Vidal), 22.23 per cent; Amuguis (*Koordersiodendron pinnatum* Merrill), 7.06 per cent; Guijo (*Shorea guiso* Bl.), 6.37 per cent; Apitong (*Dipterocarpus* sp.), 3.83 per cent; Hagachac (*Dipterocarpus lasiopodus* Perk.), 0.68 per cent, and three species of the genus *Terminalia,* Calumpit (*T. edulis* Bl.), Malagabi (*T. pellucida* Presl.), and Sacat (*T. nitens* Presl.), 1.98 per cent. These trees, which include practically all of the kinds that are lumbered at present, constitute a trifle less than one-half of the whole number which reach a size of over 40 centimeters (16 inches). Of the others, Agupanga (*Chisocheton* sp.), 7.07 per cent, Dao (*Dracontomelum mangiferum* Bl.), 5.10 per cent, and Malaguibuyo (*Celtis* sp.), 4.69 per cent, are most numerous, while the two Canariums—Pili (*C. luzonicum* A. Gray) and Pagsahiñgin (*C. villosum* Bl.), noteworthy because of the fact that they yield resins—make up 1.57 per cent. The remaining 32.26 per cent includes a number of trees, found in small numbers, some of which are valuable. Among these are Bolongeta (*Diospyros pilosanthera* Bl.), Ipil (*Intsia acuminata* Merr.), and Bansilac (*Pithecolobium lobatum* Bth.). The first named is fairly common in many places but does not reach any great size. Other large-growing species are Antipolo (*Artocarpus communis* Forst.), Baslayan (*Dehaasia triandra* Merr.), Punghan (sp. of *Lauraceæ*), Taloto (*Pterocymbium tinctorum* Merr.), Palusat Saling (*Endiandra coriacea* Merr.), Banilad (*Sterculia philippinensis* Merr.), Candol-candol (*Sterculia blancoi* Rolfe), Bancal (*Sarcocephalus cordatus* Miq.), Talimadon (*Gonystylus becanus* Gilg.), Nato (*Palaquium luzoniense* Vi.), Binuang (*Octomeles sumatrana* Miq.), Catmon (*Dillenia philippinensis* Rolfe), and Pahutan (*Mangifera altissima* Blanco).

Minor species: Butong Manoc (*Cyclostemon microphyllus* Merr.), Putat (*Barringtonia reticulata* Miq. and *B. racemosa* Bl.), and several species each of the genera *Canarium* and *Eugenia* are among the commonest of the smaller-growing trees. Near the clearings or in places where there have formerly been clearings are found Tula-tula (*Mallotus floribundus* Muell.), Alom (*Mallotus moluccanus* Muell.), Ylang-ylang (*Canangium odoratum* Baill.), a great many trees of the genus *Ficus*, and others.

Palms: Growing among the other trees are a large number of palms that seldom exceed 30 centimeters (12 inches) in diameter. The Anahao (*Livistona* sp.) (Pl. II) is widely distributed and grows to a height of 100 feet (30 meters). The Buri (*Corypha umbraculifera* L.) is seldom found except on the borders of the swamps or in very damp places. Boñgan gubat (*Areca whitfordii* Becc.) is confined largely to wet places where the ground water level is very near the surface. Yroc (*Arenga saccharifera* Labill) is scattered quite generally and is a low-growing form found beneath the larger trees. The others, Sarauag (*Pinanga insignis* Becc.), Pugahan (*Caryota* sp.), and Sagasi (*Heterospathe elata* Scheff.) are usually scattered. Table I, which shows the stand of these species, was compiled while taking valuation surveys, and as time was not taken to count all seedlings the number is considerably underestimated. It is, however, approximately correct for the two larger classes:

TABLE I.—*Stand of palms per acre (Narra type).*

[Average of 70.15 acres.]

Species.	Seedlings (without stems).	Less than 10 meters (33 feet) high.	More than 10 meters (33 feet) high.	Total.
Anahao	9.47	4.97	3.89	18.33
Yroc	8.58	5.81	1.51	15.90
Boñgan gubat	5.07	5.10	2.20	12.37
Sagasi and Sarauag	1.02	1.61	.52	3.15
Pugahan	.55	.91	.28	1.74
Buri	.77	.14		.91
Total	25.46	18.54	8.40	52.40

Soil: The soil of this type is fairly uniform. It consists of a clay surface soil, more or less mixed with humus, 10 to 12 centimeters (4 to 5 inches) in thickness, and a yellowish blue subsoil, which usually extends to the underground water level. In a few places the subsoil is mixed with sand. As far as investigations show, the underground water level is uniformly 1.5 to 3 meters (5 to 10 feet) below the surface during the dry season, and much above this during the rainy season. It is always sufficiently near the surface to be within reach of the roots of the larger trees, and during extremely wet weather large areas are flooded.

Reproduction: The dense growth of vines, especially bejuco and bamboo, hinders reproduction. Many of the trees are tolerant and can exist in the forest if the shade is not too heavy. Lauan seedlings (Pl. XII), for instance, may be found in a shade density of 75 per cent. Here the undergrowth is comparatively scarce and open. However, such favorable conditions are scattered through the forest and may be temporary only, for the breaking of limbs or tree tops, due to the wind or the constantly increasing weight of the mass of bejuco and other vines, may bring this tangle of growth in the tree tops to the surface, forming thickets so dense that little or no sunlight can reach the ground. The falling mass may also injure the pole and seedling growth that has already been established. In such a manner, areas in the forest favorable for seedlings are destroyed and the former condition is established only after a number of years. In some places, the leaves of young palms, especially those of Anahao, produce a shade density of almost 100 per cent. For intolerant species, like Narra, reproduction is poor and it is only along trails and in open places that Narra seedlings are found at all. Table II, which shows the number of poles and young trees in the area, is a fair indication of the capacity of the forest to reestablish itself.

TABLE II.—*Stand of poles and small trees per acre on Narra type.*

[Average of 70.15 acres.]

Species.	Diameter.			
	10–19 centimeters (4–7 inches).	20–29 centimeters (8–11 inches).	30–39 centimeters (12–16 inches).	Total.
Narra	0.499	0.470	0.057	1.026
Lauan	2.922	3.150	1.169	7.241
Guijo	.955	1.211	.342	2.508
Amuguis	.713	.570	.427	1.710
Apitong	.884	.698	.228	1.810
Malagabi, Sacat, Calumpit	.142	.214	.042	.398
Hagachac	.156	.128	.071	.355
Pili and Pagsahingin	.769	.912	.285	1.966
Agupanga	1.553	2.309	1.098	4.960
Malaguibuyo	.415	.641	.442	1.496
Dao	.171	.356	.128	.655
Others reaching 30 centimeters (12 inches) in diameter when mature	19.187	17.505	10.306	46.998
Trees not reaching 30 centimeters when mature	28.467	13.043	....	41.510
Total	56.831	41.207	14.595	112.633

Condition: The sylvical condition of the forest is poor. In it are many over-mature trees that should be removed as soon as possible. This is especially true of Narra. The dense undergrowth renders reproduction difficult.

Hagachac type.—On the slightly higher and better drained land adjacent to the Narra forest is a stand of timber which apparently has taken the place of Narra as the river delta has been extended. Contrasted with the Narra forest, the Hagachac type is characterized by the absence of Narra, by the presence of Hagachac (*Dipterocarpus lasiopodus* Perk.) (frontispiece), by a decrease of underbrush, and by an absence of climbing bamboo. While a consultation of the yield tables indicates that the yield is lighter in this than in the previous type, yet virgin stands of the Hagachac type are heaver. The lighter yield shown by the tables is due to the fact that some of the original forest has been cleared or cut over.

Since this type includes several detached areas, it was deemed advisable to distinguish between them for the purpose of calculating the yields separately. The main part of this description, while generally applicable to them all, will be based upon the part designated upon the map as Hagachac I, which is adjacent to the Narra type.

Hagachac Division II does not differ materially from the first except in having a smaller quantity of Guijo. While the average stand is poorer, in some places it is equally as good. Division III of the Hagachac type extends back into the low foothills, in which territory the Mangyanes, a non-Christian tribe, are found. These people have for a long time made their clearings in the forest unrestricted in any way, and have destroyed large amounts of timber. In some places the low hills have been rendered practically valueless from this cause. A single line of survey through this tract, and including a trifle over 19 acres of forest and clearings, shows a yield of approximately 2,300 feet B. M. per acre, about half of which is Hagachac. These figures have not been placed in the tables of stands and yields, as they represent so small a per cent of the forest. Division IV is a small tract of forest which lies just north of the Boñgabon River. It is of about the same grade as Hagachac II, though it has a number of minor differences, due to its proximity to the river and to the surrounding cleared land.

Leading species: Hagachac makes up 17.45 per cent of the stand of timber trees over 40 centimeters (16 inches) in diameter; Lauan, 18.28 per cent; Amuguis, 6.01 per cent; Guijo, 5.54 per cent; *Terminalia* spp., 1.65 per cent; Narra, 0.95 per cent, and Apitong, 0.23 per cent. In this, as in the Narra type, Lauan is the predominant species, although nearly equaled by the Hagachac. As a matter of fact, the Hagachac is usually grouped in favorable spots, and in such places greatly outnumbers the Lauan, which is more evenly scattered. It is not uncommon to find groups where the total stand of timber would probably run as high as 20,000 to 30,000 feet B. M. per acre.

Of the other common species, the most numerous with percentages of stand of each are Agupanga, 10.5 per cent; Dao, 6.48 per cent; Malaguibuyo, 5.19 per cent, and Pili and Pagsahiñgin, 2.25 per cent. Of the remaining trees over 40 centimeters (16 inches) in diameter, Malugay (*Dracontomelum* sp.) and Calantas (*Toona* sp.) are found scattered here and there through the forest, but are not present in merchantable quantities.

Minor species: Putat, Bolongeta, and the many species of *Eugenia*, while still found, are not so plentiful as in the Narra forest. Near the Calaanan area there are present many kinds peculiar to that type, especially species of *Ficus* and *Mallotus*.

Palms: While all the palms growing in the Narra forest are present in this type, the total number per acre is less. Buri and Boñgan gubat are nearly absent; Anahao and especially Yroc are still abundant, and Sarauag, Pugahan, and Sagasi are scattered.

Undergrowth: Climbing bamboo has practically disappeared and bejuco and other vines, though still common, are not so plentiful in the heavier stands. The smaller growing tree species still continue to form an understory, many of these being found even in the densest places. Shrubs and herbs occur in small numbers, and are relatively unimportant.

Soil: The soil here is a yellowish clay, sometimes slightly sandy, and has a small amount of humus at the surface. A sandy layer was found at a depth of about 150 centimeters (59 inches) in a few places, but is not universally present. The area, contrasted with the Narra type, is better drained.

Reproduction: Reproduction is especially good of Hagachac, seedlings, saplings, and poles being common in all places where seed trees are found. No other tree seems to reproduce so well with so little light. The reproduction of Lauan, Amuguis, and Guijo is plentiful except in the more densely shaded places. Table III shows the stand per acre of trees from 10 centimeters (4 inches) to 40 centimeters (16 inches) in diameter. The number of trees in the next to the last column (those over 30 centimeters when mature) is below the actual number. This is due to the fact that it is difficult to properly classify all of these species, no doubtful ones being listed.

TABLE III.—*Stand of poles and small trees per acre on Hagachac type.*

[Average of 34.735 acres.]

Species.	Diameter.			
	10–19 centimeters (4–7 inches).	20–29 centimeters (8–11 inches).	30–39 centimeters (12–16 inches).	Total.
Hagachac	1.756	2.072	1.180	5.008
Lauan	1.497	1.727	.575	3.799
Amuguis	.345	.489	.547	1.381
Guijo	.575	.575	.288	1.438
Dao	.288	.431	.057	.776
Malagabi, Sacat, Calumpit	.086	.173	.115	.374
Pili and Pagsahiñgin	.460	.374	.115	.949
Narra	.029	....	.029	.058
Apitong	.057	.086	....	.143
Agupanga	2.015	2.762	1.698	6.475
Malaguibuyo	.201	.488	.575	1.264
Others which will grow to be larger than 30 centimeters (12 inches)	9.328	11.631	4.980	25.939
Total	16.637	20.808	10.159	47.604

Density: In a typical stand of Hagachac, the high crowns spread over half or often all of the surface. Sometimes, however, the forest is more open than this. In nearly all cases an understory of smaller growing trees gives a comparatively dense ground cover.

Condition: The silvicultural condition is poor owing to the presence of many overmature trees, to the unfavorable conditions for reproduction, and to the presence of many inferior species. The merchantable condition is fair.

Mixed type.—Situated along the upper waters of the Madugo, Uyao, and Bayangan rivers is a tract of forest characterized by the absence of both Narra and Hagachac and by a predominance of less important species. The area is flat, rich bottom land, and has a deep clay soil, with a layer of humus at the surface.

The forest is made up of scattering groups or individuals of large and tall growing trees, the most important of which are Lauan, Guijo, and Amuguis. Malugay and Calantas occur in places, while Malaguibuyo, Dao, Agupanga, and Candol-candol are very common. Growing in between and below this upper story of trees are a large number of smaller ones. All through the forest palms are common. Especially is this true of Yroc, which grows in fairly dense shade. An abundant growth of vines and bejuco is universally present. The condition of the forest is poor, because of clearings, the scarcity of valuable trees, and their poor reproduction.

Beach type.—Since the coastal line of the tract is open and exposed to the direct action of the waves, a narrow beach has been formed, separating the swamp portion from the sea. Near the mouths of the rivers this beach is broader than the average, while in some other especially open places it is being destroyed, thus exposing small patches of the mangrove vegetation which normally lie behind the frontal zone of beach plants.

The forest of the beach is distinct (Pl. IV). Agoho (*Casuarina equisetifolia* Forst.) and the Palo Maria de la Playa (*Calophyllum inophyllum* L.) are the two leading and distinctively characteristic trees. In places the former grows in nearly pure stands and extends inland along the Bongabon River (Pl. V) for about a mile. Besides those mentioned, the usual beach plants of the Tropics are found. Among the trees, Botong (*Barringtonia speciosa* Forst.), Dap-dap (*Erythina indica* Lam.), Talisay (*Terminalia catappa* L.), and Balabago (*Hibiscus tiliaceous* L.) are the more common. Guijo, Amugius, Apitong, and Ipil are among the timber trees that occur, but not in merchantable quantities, on the landward side of the beach. Pandan (*Pandanus tectorius* Sol.), Cycad (*Cycas circinalis* L.), and many other shrubby plants are found. The Agoho reproduces well and rapidly in most places, but reproduction of Palo Maria is more scattered and in some places entirely absent.

Unclassified commercial forest.—This part of the forest was given very little examination, although it was seen to be of commercial importance. Both sides of the Boñgabon River valley along its upper waters were lined with tree growth. A strip taken to the north at a distance of 9 miles up this river showed a stand in which were found Lauan, Amugius, some Guijo, and many other large-sized trees. The country here is hilly. An elevation of 260 meters (850 feet) was reached within a mile of the river. Mangyan clearings have destroyed large quantities of timber, and the outlook from this hill and from others indicates that the same conditions exist over the major part of the foothill region, which makes up the back portion of the tract. Logging in this territory is not advisable under present conditions.

Noncommercial forests.—In addition to the types of commercial forest already named and described, there are considerable areas covered with tree growth not suited for lumbering under present conditions, and some of it not at all. While a complex classification of this part might be made, the part examined has been divided into two parts and the native names for these used. Naturally these grade into each other and lines of division are difficult to fix. Fundamentally, however, the distinction between them is clear. The first, or "Guipa" type, is uncut noncommercial forest, containing many large, though at present noncommercial, varieties of trees. The "Calaanan" type is the second-growth forest on land which has been cleared and used for agricultural purposes, and then abandoned.

Guipa type.—In most cases the Guipa forest appears to be the first high forest growth on areas where the underground water level is very near the surface. Such areas are usually abandoned river channels and flood plains, and, excepting along the Boñgabon River, are very near the coast.

Some idea of the stand and species of the larger trees may be obtained from a rapid count made over 1.7 hectares (4.2 acres) of land in the Guipa south and southeast of the Payang cogonal, where the following are found: Seventeen Dao, 4 Antipolo, 1 Cupang (*Parkia roxburghii* G. Don), 1 Lauan, 1 *Terminalia*, 1 Malaguibuyo, and 1 Bancal, as the more promising of the larger trees. In another place, on an area of 1.6 hectares (3.95 acres) running through the central part of the narrow strip of Guipa between the Anilao River and the barrio of Masaguisi, are found 9 Dao, 3 Amuguis, 5

Toog (*Bischofia trifoliata* Hook.), 3 Bancal, 3 Pagsahingin, 1 Antipolo, 1 Calantas, 1 Narra, 1 Pili, and a few other trees with diameters greater than 40 centimeters (16 inches). These two places represent two of the best portions of the Guipa forest. In both of them, as elsewhere in this type, Catmon is the most characteristic tree, although it rarely reaches a diameter of over 40 centimeters (16 inches).

Palms, especially Anahao and Yroc, are very plentiful. The undergrowth is composed of small trees, vines, and bejuco, and is generally quite dense. Reproduction is fair of the trees present, although in some places the lack of desirable seed trees prevents the reproduction of the better kinds. The soil is rich and varies from a loamy clay to a loamy sand.

Calaanan type.—The Calaanan stands in sharp contrast to all of the forest types thus far described (Pl. VI). While the others have been fundamentally natural divisions, this one is distinctly artificial and the direct result of the influence of man. It may be best understood by briefly describing its origin.

A long-standing custom for those raising agricultural crops has been to go into the forest at the commencement of the dry season, cut all of the trees over a small area, and leave them until near the end of the dry season. The slash is then burned, and upon the excellent seed bed left the desired crops are planted. After growing crops for two or three years, the lack of any kind of tools for working the land allows the entrance of weeds, grass, etc., so that it is easier to clear a new place than to clean out the old. As a result of these methods, large areas have been cut over, abandoned, grown up, and perhaps cut over again and again. Thus they have been rendered worthless for forest purposes.

The composition of the Calaanan varies considerably in different places. In portions bordering upon or near to the commercial forest, saplings and small poles of adjacent timber species are common. In other places, where the land has been worked for a longer time before abandonment, and where the clearings are near to grass lands, cogon grass (*Imperata exaltata* Brongn.) is mixed with the Calaanan. In still other places there is almost a pure stand of typical Calaanan trees. Taken as a whole, this type is made up of rapid-growing and quick-maturing varieties, which seed abundantly and at an early age. The first to come in, and one of the widest in distribution of these, is Binunga (*Macaranga tanarius* Muell.) (Pl. VI). This seeds at an early age, grows with wonderful rapidity, and while most of the trees die early, some reach the size of forest trees. Commonly growing with this are a number of species of the genera *Mallotus*, *Macaranga*, and *Ficus*.

Table IV gives the number of trees upon a plot one-fortieth of a hectare (one-sixteenth of an acre) taken in the midst of a young Calaanan forest situated so far away from the commercial forest as to be entirely unaffected by it. In this Calaanan there is an unusually large proportion of Binunga and Alom, the former being much the taller, having an average height of 14 meters (45 feet).

TABLE IV.—*Number of trees on one-fortieth of a hectare (about one-sixteenth of an acre) of young Calaanan not adjacent to the commercial forest.*

Species.	Seedlings less than 1 meter (3 feet) high.	Diameter.			
		1–5 centimeters (⅓–2 inches).	5–10 centimeters (2–4 inches).	10–15 centimeters (4–6 inches).	Total.
Macaranga tanarius Muell			43	27	70
Mallotus moluccanus Muell	1	22	1	1	25
Macaranga playfairii Hemsl		22	2	1	25
Ficus hauili Blanco		8	3		11
Leea sp	2	4	3		9
Ficus mindoriensis Merr	1	3	1		5
All others (8 species)	8	9	1		18
Dead trees		58	21	2	
Total live trees	12	68	54	29	163

As already stated, Calaanan near the forest usually contains a large number of forest tree seedlings, and would no doubt eventually produce excellent forest if left undisturbed. An old Calaanan near the Narra forest illustrates this point. Table V shows the number of trees found upon two plots, each one-fortieth of a hectare (one sixteenth of an acre) in area.

TABLE V.—*Number of trees on one-twentieth of a hectare (about one-eighth of an acre) of old Calaanan adjacent to the commercial forest.*

Species.	Seedlings less than 1 meter (3 feet) high.	Diameter.					
		1–5 centimeters (½–2 inches).	5–10 centimeters (2–4 inches).	10–15 centimeters (4–6 inches).	15–20 centimeters (6–8 inches).	20–30 centimeters (8–12 inches).	Total.
Lauan	30	19	6	1			56
Guijo	27	16					43
Amuguis	21	3	1				25
Pahutan	2						2
Bancal		2		1			3
Pili	2	1					3
Ficus (several species)	4	10	11	4	4		33
All others	71	55	18	3	2	4	153
Total	157	106	36	9	6	4	318

The following is a list of trees which are typical Calaanan trees, though they are often found in other forest types:

Ficus minahassae Miq. (Hagimit), *F. hauili* Blanco (Hauili), *F. nota* Merr. (Tibig), *F. variegata* Merr. (Tañgisang bayauac T.), *Macaranga tanarius* Muell. (Binuñga), *M. bicolor* Muell., *Mallotus barnesii* Merr., *M. playfairii* Hemsl., *M. floribundus* Muell., *M. riciniodes* Muell., *M. moluccanus* Muell. (Alom); *Stylocoryne macrophylla* Bartl. (Basa), *Trema amboinense* Bl. (Knugdon), *Mussaenda grandiflora* Rolfe, *Clerodendron macrostegium* Sch., *Laportea meyeniana* Ward. (Lipa), *Voacanga cumingii* Rolfe, *Phaeanthus cumingii* Miq., *Callicarpa erioclona* Schauer, *C. blancoi* Rolfe, and *C. formosana* Rolfe.

Unclassified noncommercial forests.—Two small tracts of forest, one near the Sucol and one near the Uasig River, appear on the map under the above heading. These have not been examined carefully and hence no attempt has been made to classify them. It is believed that the part near the Sucol River contains small areas of commercial forest, otherwise they are apparently made up of a mixture of Guipa, Calaanan, and grass land.

SWAMP TYPES.

Mangrove type.—Behind the narrow strip of land along the shore that is occupied by the beach forest is a flat area, often quite wide, that is flooded at high tide. Here an excessive amount of salt water gives rise to the so-called mangrove vegetation (Pl. VII), which is composed of a dense stand of trees from 15 to 30 centimeters (6 to 12 inches) in diameter and from 8 to 12 meters (26 to 40 feet) in height. Many of these trees have long stilt roots, which form a very characteristic appearance, especially noticeable since the ground is free from undergrowth.

Members of the family *Rhizophoraceæ* compose this type almost to the exclusion of all others. The following species are characteristic: *Rhizophora mucronata* Lam., *R. conjugata* L., *Bruguiera gymnorrhiza* Lam., *B. parviflora* Lam., *B. eriopetala* Wanda., *B. caryophylliodes* Blume, *Ceriops candolleana* Arn., and *C. roxburghiana* Arn. While the species of *Rhizophora* and *Bruguiera* have the common names of Bacao or Bacauan, and those of the *Ceriops*, Tañgal, these names are often interchangeable and the different species of the genera have such a variety of individual common names that no attempt is made to collect them. Besides the *Rhizophoraceæ*, Pagatpat (*Sonneratia pagatpat* Blanco), Apiapi (*Avicennia officinalis* L.), and Nilad (*Scyphiphora hydrophyllacea* Gærtn.) are present. On the slightly higher areas Tabigue (*Xlyocarpus obovatus* Juss. and X. *granatus* Koenig) and Dungonlate (*Heritiera littoralis* Dry.) are quite common.

The mangrove swamps are important commercially because they are the principal source of firewood in the Philippines and because species of Bacauan, Tañgal, and Tabigue furnish valuable tan barks and dye barks. While in many parts of the Philippines the mangrove swamps have been greatly damaged by long-continued cutting, those within this tract are in excellent condition and will furnish, with proper management, a constant supply of firewood, tan bark, and dye bark. Reproduction in them is good since the trees seed continuously and freely.

Nipa type.—Near the upper limit of high tide and on strips along the tidal portion of fresh-water streams the saline condition of the soil is less pronounced. These places are occupied by the Nipa palm (*Nipa fruticans* Wurmb.), which appears as the commonest and characteristic growth. Nipa is often found in nearly pure stands, though occasionally it is mixed with the mangrove species. In the upper limits of the Nipa swamp considerable areas are occupied by the swamp fern, Lagolo (*Achrostichum aureum* L.) and by Doloarin (*Acanthus ilicifolius* L.). The former occurs most frequently. Evidently the Nipa would grow and do well on the land occupied by the mangrove vegetation, but is probably shaded out by it.

Buri type.—Behind the mangrove and Nipa swamp is a belt not flooded at any time by the tide, yet containing too much water for the growth of forest trees. Here is usually an almost pure stand of the Buri palm (*Corypha, umbraculifera* L.). Toward its higher limits it is mixed with shrubs and forest trees, and merges quickly into forest types. Reproduction is very plentiful, and large numbers of young plants are to be found. The Buri palm is not necessarily confined to the area bordering on the Nipa, but may form dense growth along the streams, especially if these run through or border on the grass areas.

OTHER AREAS.

Grass land.—The broad sandy and rocky flood plain of tñe Bongabon River is apparently natural grass land. In places where the action of the floods is strongest, scattered clumps of Talahib (*Saccharum spontaneum* L.) are practically the only vegetation found. Toward the outer edges of the flood plain this grass forms a dense jungle from 2 to 3 meters (7 to 10 feet) in height. Fires sweep through it periodically, partially burning the driest and killing the greenest portions. In this way there has accumulated at the base a dense mass of dead and partially burned grass that is often 1 meter or more in depth, which is sufficient to prevent the seeding of forest trees. In the thinner portions, where the seeding is possible, fires are instrumental in checking forest growth. Mention has already been made of the extension of the coastal belt of Agoho up the Bongabon River valley. It is believed from observations made in other parts of the islands that the habitat occupied by the Talahib is especially suited to Agoho, and were it not for fires this tree would form in places pure stands. At the upper limits of the extension of this tree an excellent advance zone of seedlings and young trees was observed. A later visit to the same place showed a fire destroying this stand.

A few ox-bow channels cut off from the main streams are filled with Tagpo (*Phragmites* sp.), and in places there is an extension of the grasss zone as peninsulas into the forest, which evidently marked the existence of old river channels. The Baroc River flood plain is similar to that of the Bongabon River, but on a much smaller scale. The banks of all the other rivers are clothed with forest, except where the clearings have allowed cogon to come in. At present these river-bottom grass lands are practically valueless, although they furnish pasturage for such wild game as timarau, deer, and wild carabao.

Cultivated lands.—Scattered in small areas along roads and trails in almost all parts of the tract are small cultivated fields. These are more numerous near the villages and along the river valleys. In the part of the tract near the mountains the Mangyanes have destroyed large portions of the forest by clearings. The portion of the tract actually under cultivation is estimated at 2 per cent. Since the areas are small, they are not indicated on the map.

STAND.

The stand tables given here for trees over 40 centimeters (16 inches) in diameter were computed for each type separately. Whenever possible diameters have been taken at breast height, but in case of trees having high buttresses the diameters were taken above the swell

NARRA TYPE STAND.

Table VI was computed from valuation surveys taken over 70.15 acres (28.388 hectares) or 2.035 per cent of the whole amount of the tract, which contains 3,447 acres. This type includes some territory around the mill which has been partially cut over and some bordering on inferior types of forest, consequently the main part of the tract contains a slightly heavier stand than that shown for the average acre.

TABLE VI.—*Stand per acre on Narra type (3,447 acres).*

[Average of 70.15 acres.]

Diameter above buttresses.		Narra.	Lauan.	Guijo.	Amuguis.	Apitong.	Malagabi, Sacat, Calumpit.
Inches.	*Centimeters.*						
16	40	0.042	0.627	0.242	0.128	0.099	0.071
18	45	.085	.669	.285	.156	.099	.028
20	50	.199	.613	.156	.128	.085	.042
22	55	.242	.513	.199	.285	.071	.099
24	60	.185	.556	.099	.299	.114	.057
26	65	.199	.470	.142	.199	.085	.028
28	70	.171	.456	.114	.213	.128	.028
30	75	.099	.313	.185	.156	.042	.042
31	80	.114	.256	.042	.099	.071	.014
33	85	.085	.456	.085	.071	.071	.014
35	90	.128	.228	.042	.085	.071	.042
37	95	.071	.156	.028	.042	.014	.014
39	100	.085	.142	....	.014	.028	.028
41	105	.028	.142	.028	.014	.014	....
43	110	.042	.156	.028	....	....	.014
45	115	.042	.057	.014	.014	....	....
47	120	.057	.057	.028	....	....	....
49	125	.028	.071	....	....	.028	.014
51	130	....	....	....	....	.014	....
53	135	....	.042	....	....	....	....
55	140	....	.014	....	....	....	....
57	145	....	....	....	....	....	....
59	150	.014	....	....	....	....	....
78	200	.014	....	....	....	....	....
Total:							
Per acre.....		1.930	5.994	1.717	1.903	1.034	.535
Per hectare..		4.769	14.811	4.243	4.702	2.555	1.322
Per cent.....		7.16	22.23	6.37	7.06	3.83	1.98

Diameter above buttresses.		Hagachac.	Pili and Pagsahingin.	Agupanga.	Malaguibuyo.	Dao.	Others.	Total.
Inches.	*Centimeters.*							
16	40	0.042	0.156	0.826	0 199	0.085	2.409	4.926
18	45	.014	.057	.356	.299	.028	1.682	3.758
20	50	....	.057	.299	.228	.099	1.040	2.946
22	55	.014	.014	.142	.156	.042	.841	2.618
24	60	....	.042	.114	.128	.156	.841	2.591
26	65	.028	.042	.099	.128	.085	.441	1.946
28	70	....	.014	....	.057	.156	.413	1.750
30	75	.014	.028	.028	.028	.028	.199	1.162
31	80	....	.014	.014	.014	.128	.213	.979
33	85	.014	....	.014	.014	.114	.213	1.151
35	90	....	....	.014	.014	.085	.142	.851
37	95	....	....	....	....	.099	.028	.452
39	100	....	....	....	....	.085	.028	.410
41	105	.028	....	....	....	.014	.028	.296
43	110	.014	....	....	....	.057	.042	.353
45	115	....	....	....	....	.014	....	.141
47	120	....	....	....	....	.057	.014	.213
49	125	....	....	....	....	....	.042	.183
51	130	....	....	....	....	.028	.042	.084
53	135	.014	....	....	....	....	....	.056
55	140	....	....	....	....	.014	.014	.042
57	145	....	....	....	....	....	....	....
59	150	....	....	....	....	....	.014	.028
78	200	....	....	....	....	....	.014	.028
Total:								
Per acre.....		.182	.424	1.906	1.265	1.374	8.700	26.964
Per hectare..		.450	1.048	4.709	3.126	3.395	21.498	66.628
Per cent.....		.68	1.57	7.07	4.69	5.10	32.26	100

HAGACHAC TYPE STAND.

Table VII was computed from surveys made over 34.73 acres (14.057 hectares) or 2.052 per cent of the territory of the part of the Hagachac type designated as Hagachac I, which contains 1,692 acres.

TABLE VII.—*Stand per acre on Hagachac I type* (*1,692 acres*).

[Average of 34.74 acres.]

Diameter above buttresses.		Hagachac.	Lauan.	Amuguis.	Guijo.	Malagabi, Sacat, Calumpit.	Pili and Pagsahingin.
Inches.	*Centimeters.*						
16	40	0.748	0.460	0.230	0.086	0.115	0.173
18	45	.403	.460	.115	.201	.057	.173
20	50	.374	.575	.115	.086	.057	.029
22	55	.489	.345	.173	.259	.086	.029
24	60	.288	.632	.374	.057	.029	.057
26	65	.230	.374	.144	.086	....	.029
28	70	.316	.259	.057	.173	....	.029
30	75	.144	.345	.115	.086	....	....
31	80	.230	.173	.029	.029	.029	....
33	85	.144	.115	.057	.057	....	.029
35	90	.201	.259	.029	.029	....	....
37	95	.144	.173	.029	.029	....	....
39	100	.173	.086	....	.029	....	....
41	105	.115	.086	....	.029	....	....
43	110	.057	.029	....	.057	.029	....
45	115	.057	.029	....	.029	....	....
47	120	.057	.029	....	.029	....	....
49	125	.029	....	....	....	....	....
51	130	.029	....	....	....	....	....
53	135	....	.029	....	....	....	....
55	140	....	....	....	....	....	....
57	145	....	....	....	....	....	....
59	150	....	....	....	....	....	....
61	155	....	....	....	....	....	....
63	160	.029	....	....	....	....	....
Total:							
Per acre......		4.257	4.458	1.467	1.351	.402	.548
Per hectare...		10.519	11.016	3.625	3.338	.994	1.354
Per cent......		17.45	18.28	6.01	5.54	1.65	2.25

Diameter above buttresses.		Narra.	Apitong.	Dao.	Agupanga.	Malaguibuyo.	All others.	Total.
Inches.	*Centimeters.*							
16	40	0.029	....	0.144	0.720	0.173	2.015	4.893
18	45	....	....	.115	.575	.086	.892	3.077
20	50	....	0.057	.057	.403	.374	.949	3.076
22	55	....	....	.086	.316	.201	.518	2.502
24	60	.029	....	.230	.316	.115	.345	2.472
26	65	.057	....	.173	.144	.115	.345	1.697
28	70	....	....	.086	.057	.144	.345	1.466
30	75	....	....	.029	.029	....	.115	.863
31	80	.029	....	.029	....	.029	.230	.807
33	85	.057	....	.144	....	....	.029	.632
35	90	.029	....	....	....	.029	.115	.691
37	95	....	....	.173	....	....	.057	.605
39	100	....	....	.086	....	....	.057	.431
41	105	....	....	....	....	....	.057	.287
43	110	....	....	.057	....	....	.029	.258
45	115	....	....	.057	....	....	....	.172
47	120	....	....	.086	....	....	.029	.230
49	125	....	....	....	....	....	....	.029
51	130	....	....	....	....	....	....	.029
53	135	....	....	....	....	....	....	.029
55	140	....	....	.029	....	....	.029	.058
57	145	....	....	....	....	....	....	....
59	150	....	....	....	....	....	.057	.057
61	155	....	....	....	....	....	....	....
63	160	....	....	....	....	....	....	.029
Total:								
Per acre.....		.230	.057	1.581	2.560	1.266	6.213	24.390
Per hectare..		.568	.141	3.907	6.326	3.128	15.352	60.268
Per cent....		.95	.23	6.48	10.50	5.19	25.47	100

Table VIII is computed from valuation surveys made over 25.11 acres (10.16 hectares) or 1.254 per cent of the territory designated on the map as Hagachac II, which contains approximately 2,000 acres. The scattered and varied condition of this forest is such that the small per cent taken in these surveys must not be accepted as an absolute statement of the stand. It is believed, however, that the actual stand will exceed rather than fall below this estimate.

TABLE VIII.—*Stand per acre on Hagachac II type (2,000 acres).*

[Average of 25.11 acres.]

Diameter above buttresses.		Haga-chac.	Lauan.	Amu-guis.	Guijo.	Dao.	Malagui-buyo.
Inches.	*Centimeters.*						
16–19	40–49	0.477	0.477	0.318	0.079	0.199	1.991
20–23	50–59	.557	.438	.159	.079	.438	.677
24–27	60–69	.358	.796	.557	.079	.477	.796
28–30	70–79	.557	.278	.477	.040	.398	.238
31–34	80–89	.278	.159	.079	.040	.238	....
35–38	90–99	.238	.119	.119	.040	.159	....
39–42	100–109	.318	.040	.079	....	.159	....
43–46	110–119	.040	.040	....	....	....	....
47–50	120–129	.119	.040	....	....	.079	....
Total:							
Per acre......		2.942	2.387	1.788	.357	2.147	3.702
Per hectare..		7.270	5.898	4.418	.882	5.305	9.148
Per cent......		13.60	11.03	8.26	1.65	9.92	17.11

Diameter above buttresses.		Agu-panga.	Candol-candol.	Mala-gabi, Sacat, Calum-pit.	Others.	Total.
Inches.	*Centimeters.*					
16–19	40–49	1.353	0.597	....	1.233	6.724
20–23	50–59	.836	.517	0.079	.717	4.497
24–27	60–69	.517	.199	....	.637	4.416
28–30	70–79	.040	.119	.119	.557	2.823
31–34	80–89	.040	....	.079	.278	1.191
35–38	90–99	....	....	.040	.199	.914
39–42	100–109	....	....	....	.079	.675
43–46	110–119	....	....	....	.040	.120
47–50	120–129	....	....	....	.040	.278
Total:						
Per acre......		2.786	1.432	.317	3.780	21.638
Per hectare..		6.884	3.539	.783	9.340	53.467
Per cent......		12.88	6.62	1.46	17.47	100

MIXED TYPE STAND.

Table IX is computed from valuation surveys made over 34.7 acres (14.07 hectares) or 0.82 per cent of the total area for this type, which is approximately 4,200 acres. The variable character of this forest is such as to render this small per cent insufficient data for certain conclusions. The general stand is poor and the forest more or less mixed with clearings and Calaanan. More complete data would no doubt show a considerable variation from these figures.

TABLE IX.—*Stand per acre on mixed type (4,200 acres).*

[Average of 34.7 acres.]

Diameter above buttresses.		Lauan.	Amuguis.	Guijo.	Dao.	Malagabi, Sacat, Calumpit.	Malaguibuyo.	Agupanga.	Others.	Total.
Inches.	*Centimeters.*									
16-19	40-49	0.403	0.230	0.230	0.028	0.115	1.555	0.748	1.296	4.605
20-23	50-59	.720	.259	.201	.288	....	.748	.431	1.123	3.770
24-27	60-69	.633	.230	.086	.259	.144	.662	.374	.691	3.079
28-30	70-79	.259	.115	.259	.316	.086	.230	.201	.403	1.869
31-34	80-89	.317	.172	.201	.259	.028	.086	.028	.345	1.436
35-38	90-99	.057	....	.057	.057	....	....	....	.028	.199
39-42	100-109	.057	.057	.057	.316	.028	....	....	.144	.659
43-46	110-119	....	....	....	.086	....	....	....	....	.086
47-50	120-129	.057	....	....	.086	....	....	....	....	.143
Total:										
Per acre		2.503	1.063	1.091	1.695	.401	3.281	1.782	4.030	15.846
Per hectare		6.185	2.627	2.696	4.188	.991	8.107	4.403	9.958	39.155
Per cent		15.80	6.71	6.89	10.70	2.53	20.70	11.24	25.43	100

VOLUME TABLES.

Owing to the fact that almost no cutting was going on during field work on the tract, very few measurements of felled trees were made. These volume tables have been computed largely from data taken by Forester Everett in Negros, Forester Maule in Bataan, and Forester Klemme in Tayabas, and checked with a few measurements taken upon the tract. In every case, however, it has been the purpose to make conservative estimates. Three tables are given, one for Narra, a low-growing tree; one for Amuguis and species of *Terminalia*, which are of medium height; and one for *Dipterocarpaceæ*, which includes Lauan, Apitong, Guijo, and Hagachac. The latter trees are tall growing, and, while they differ from each other, it was thought best to use one table for them all. A comparison of this latter table with that given for the Yellow Poplar [a] (*Liriodendron tulipifera* L.) of the United States, which very much resembles in general form and habits of growth these *Dipterocarps*, shows a marked similarity between the two.

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[a] See Braniff, E. A.: Grades and Amounts of Lumber Sawed from Yellow Poplar, etc. *U. S. Dept. of Agriculture, For. Ser., Bull. 73* (1906).

TABLE X.—*Volume table.*

Diameter.		Narra.		Amuguis, Malagabi, Sacat, Calumpit.		Lauan, Guijo, Hagachac, Apitong.	
		Board feet Doyle.	M³.	Board feet Doyle.	M³.	Board feet Doyle.	M³.
Inches.	*Cm.*						
16	40	140	0.500	210	0.875	210	0.875
18	45	195	.745	285	1.150	285	1.310
20	50	235	1.005	350	1.420	390	1.725
22	55	300	1.320	416	1.775	445	2.250
24	60	370	1.555	505	2.200	680	3.150
26	65	450	1.950	622	2.550	910	3.640
28	70	550	2.275	760	2.920	1,170	4.315
30	75	650	2.540	885	3.310	1,380	5.110
31	80	740	2.955	1,045	3.870	1,615	6.000
33	85	821	3.250	1,200	4.310	1,804	6.850
35	90	915	3.625	1,360	4.750	2,115	7.650
37	95	1,010	3.950	1,465	5.320	2,420	8.325
39	100	1,115	4.350	1,640	5.901	2,685	8.900
41	105	1,220	4.800	1,820	6.300	2,982	9.540
43	110	1,310	5.200	1,985	6.595	3,200	10.276
45	115	1,430	5.560	2,160	6.980	3,450	10.900
47	120	1,550	6.200	2,375	7.350	3,685	11.500
49	125	1,622	6.620	2,600	7.500	3,965	12.120
51	130	....	....	....	....	4,215	12.500
53	135	....	....	....	....	4,500	13.000
55	140	....	....	....	....	4,650	13.000

YIELD.

The yield tables have been computed for each type separately by applying the proper volume table to the number of trees of each diameter class which was found upon that type. While the yields can not be accepted as being accurate, owing to the nature of the volume tables used, it has been thought advisable to include them as being a conservative estimate of the yield.

TABLE XI.—*Yield in board feet on Narra type (3,447 acres).*

Species.	Cutting to a diameter limit of 40 centimeters (16 inches).		Cutting to a diameter limit of 50 centimeters (20 inches).	
	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
Narra	1,249	4,305,303	1,224	4,219,128
Lauan	6,855	23,629,185	6,532	22,515,804
Guijo	1,582	5,453,154	1,450	4,998,150
Apitong	1,200	4,136,400	1,150	3,964,050
Amuguis	1,260	4,343,220	1,188	4,095,036
Malagabi Sacat Calumpit	408	1,406,376	385	1,327,095
Hagachac	285	982,395	272	937,584
Total	12,839	44,256,033	12,201	42,056,847
Per hectare	31,725	....	30,148	....

TABLE XII.—*Yield in cubic meters on Narra type (1,395 hectares).*

Species.	Cutting to a diameter limit of 40 centimeters (16 inches).		Cutting to a diameter limit of 50 centimeters (20 inches).	
	Average yield per hectare.	Total yield.	Average yield per hectare.	Total yield.
Narra	12.50	17,437.50	12.28	17,130.60
Lauan	62.55	87,257.25	59.03	82,346.85
Guijo	14.90	20,785.50	13.46	18,776.70
Apitong	11.03	15,386.85	10.49	14,633.55
Amuguis	12.08	16,851.60	11.36	15,847.20
Malagabi	3.75	5,231.25	3.52	4,910.40
Sacat				
Calumpit				
Hagachac	2.39	3,334.05	2.24	3,124.80
Total	119.20	166,284.00	112.38	156,770.10
Per acre	48.24		45.48	

TABLE XIII.—*Yield in board feet on Hagachac I type (1,692 acres.)*

Species.	Cutting to a diameter limit of 40 centimeters (16 inches).		Cutting to a diameter limit of 50 centimeters (20 inches).	
	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
Hagachac	4,815	8,146,980	4,543	7,686,756
Lauan	4,526	7,657,992	4,298	7,272,216
Guijo	1,497	2,532,924	1,421	2,404,332
Amuguis	798	1,350,216	711	1,203,012
Malagabi	198	335,016	158	267,336
Sacat				
Calumpit				
Narra	135	228,420	131	221,652
Apitong	22	37,224	22	37,224
Total	11,991	20,288,772	11,284	19,092,528
Per hectare	29,629		27,882	

TABLE XIV.—*Yield in cubic meters on Hagachac I type (685 hectares).*

Species.	Cutting to a diameter limit of 40 centimeters (16 inches).		Cutting to a diameter limit of 50 centimeters (20 inches).	
	Average yield per hectare.	Total yield.	Average yield per hectare.	Total yield.
Hagachac	43.28	29,646.80	40.36	27,646.60
Lauan	42.42	29,057.70	39.94	27,358.90
Guijo	13.71	9,391.35	12.87	8,815.95
Amuguis	7.89	5,404.65	7.06	4,836.10
Malagabi	1.89	1,294.65	1.48	1,013.80
Sacat				
Calumpit				
Narra	1.35	924.75	1.31	897.35
Apitong	.24	164.40	.24	164.40
Total	110.78	75,884.30	103.26	70,733.10
Per acre	44.83		41.79	

TABLE XV.—*Yield in board feet on Hagachac II type (2,000 acres).*

Species.	Cutting to a diameter limit of 40 centimeters (16 inches).		Cutting to a diameter limit of 50 centimeters (20 inches).	
	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
Hagachac	4,078	8,156,000	3,942	7,884,000
Lauan	2,410	4,820,000	2,234	4,468,000
Amuguis	1,328	2,656,000	1,237	2,474,000
Guijo	333	666,000	310	620,000
Malagabi	256	512,000	256	512,000
Sacat				
Calumpit				
Total	8,405	16,810,000	7,979	15,958,000
Per hectare	20,768		19,716	

TABLE XVI.—*Yield in cubic meters on Hagachac II type (810 hectares).*

Species.	Cutting to a diameter limit of 40 centimeters (16 inches).		Cutting to a diameter limit of 50 centimeters (20 inches).	
	Average yield per hectare.	Total yield.	Average yield per hectare.	Total yield.
Hagachac	36.46	29,532.60	34.92	28,285.20
Lauan	22.90	18,549.00	21.35	17,293.50
Amuguis	12.60	10,206.00	11.70	9,477.00
Guijo	3.26	2,640.60	3.01	2,438.10
Malagabi	2.37	1,919.70	2.38	1,919.70
Sacat				
Calumpit				
Total	77.59	62,847.90	73.35	59,413.50
Per acre	31.40		29.68	

TABLE XVII.—*Yield in board feet on mixed type (4,200 acres).*

Species.	Cutting to a diameter limit of 40 centimeters (16 inches).		Cutting to a diameter limit of 50 centimeters (20 inches).	
	Average yield per acre.	Total yield.	Average yield per acre.	Total yield.
Lauan	2,466	10,357,200	2,351	9,874,200
Guijo	1,267	5,321,400	1,201	5,044,200
Amuguis	721	3,028,200	655	2,751,000
Malagabi	280	1,176,000	257	1,079,400
Sacat				
Calumpit				
Total	4,734	19,882,800	4,464	18,748,800
Per hectare	11,697		11,020	

TABLE XVIII.—*Yield in cubic meters on mixed type (1,700 hectares).*

Species.	Cutting to a diameter limit of 40 centimeters (16 inches).		Cutting to a diameter limit of 50 centimeters (20 inches).	
	Average yield per hectare.	Total yield.	Average yield per hectare.	Total yield.
Lauan	23.84	40,528	22.54	38,318
Guijo	11.88	20,196	11.13	18,921
Amuguis	6.92	11,764	6.27	10,659
Malagabi Sacat Calumpit	2.67	4,539	2.34	3,978
Total	45.31	77,027	42.28	71,876
Per acre	18.33	....	17.11	....

TABLE XIX.—*Total yield in board feet on Narra, Hagachac, and mixed types (11.339 acres).*

[Cutting to a diameter limit of 40 centimeters (16 inches).]

Species.	Narra type.	Hagachac I type.	Hagachac II type.	Mixed type.	Total yield.	Per cent.
Narra	4,305,303	228,420	....	....	4,533,723	4.48
Hagachac	982,395	8,146,980	8,156,000	....	17,285,375	17.07
Lauan	23,629,185	7,657,992	4,820,000	10,357,200	46,464,377	45.90
Amuguis	4,343,220	1,350,216	2,656,000	3,028,200	11,377,636	11.24
Guijo	5,453,154	2,532,924	666,000	5,321,400	13,973,478	13.80
Apitong	4,136,400	37,224	....	....	4,173,624	4.12
Malagabi Sacat Calumpit	1,406,376	335,016	512,000	1,176,000	3,429,392	3.39
Total	44,256,033	20,288,772	16,810,000	19,882,800	101,237,605	100

TABLE XX.—*Total yield in board feet on Narra, Hagachac, and mixed types (11.339 acres).*

[Cutting to a diameter limit of 50 centimeters (20 inches).]

Species.	Narra type.	Hagachac I type.	Hagachac II type.	Mixed type.	Total yield.	Per cent.
Narra	4,219,128	221,652	....	....	4,440,780	4.6⅓
Hagachac	937,584	7,686,756	7,884,000	....	16,508,340	17.2
Lauan	22,515,804	7,272,216	4,468,000	9,874,200	44,130,220	46
Guijo	4,998,150	2,404,332	620,000	5,044,200	13,066,682	13.6⅓
Amuguis	4,095,036	1,203,012	2,474,000	2,751,000	10,523,048	11
Apitong	3,964,050	37,224	....	....	4,001,274	4.2
Malagabi Sacat Calumpit	1,327,095	267,336	512,000	1,079,400	3,185,831	3.3⅓
Total	42,056,847	19,092,528	15,958,000	18,748,800	95,856,175	100

DESCRIPTION OF TREE SPECIES.

Narra (*Pterocarpus indicus*).—This tree occurs throughout the forest on the lowlands back of the large mangrove swamp near Daihagan Point. It is a tree of the newly made flats and is seldom found in the higher and older forest farther back. It is known on the market as Yellow Narra.

Narra is a low-branching, spreading tree, usually producing a bole with a merchantable length of from 8 to 10 meters, or about 30 feet. (Pl. VIII.) The bole is angular and irregular in cross section. The average diameter of trees over 40 centimeters (16 inches) is 73.86 centimeters (27.07 inches). Many of the logs of Narra, especially of he old trees, are defective at the center. Narra has wide, flat buttresses, from which table tops from 5 to 6 feet in diameter are often taken. (Pl. IX.) It demands considerable light and is never found in dense clumps. Reproduction is poor, excepting in a few open places. It sprouts freely from the stumps, and logs lying upon the ground send out both roots and shoots. It could probably be propagated from cuttings planted in the wet season.

Narra is, without question, the most valuable timber found on the tract. The wood of Narra is moderately heavy, moderately hard, very durable, and is seldom if ever attacked by the white ant. It is especially valuable for cabinet work, and is also a valuable construction timber.

Hagachac (*Dipterocarpus lasiopodus*).—Hagachac is found on the higher, better-drained portions in the older forests, upon the flats, and the low foothills. Growing more or less in clumps, it is usually the predominant species in places where it is found.

Hagachac produces a tall, even bole (Pl. X), almost round in cross section. A tree of average height, with a stump diameter of 70 centimeters (28 inches), which was felled and measured, had a clear length of 30 meters to the first branch, at which place its diameter was 38 centimeters. Often higher trees than this are found. An average diameter of 66.31 centimeters (26.1 inches) was found for trees over 40 centimeters (16 inches) in diameter. The tree has few exterior defects, and is usually sound throughout. It is not usually strongly buttressed, although on old trees there is a large root swell. Hagachac seeds plentifully and reproduces as well or better in shady places than any other timber tree. The young saplings and poles grow rapidly and soon shoot up above the surrounding vegetation, where they receive an abundance of light. Hagachac has been but little cut and is sold under the name of Apitong.

Lauan (*Shorea contorta*).—This is the most widely distributed tree in the forest. It is found in limited numbers in every type of lowland forest, except the swamps, and is also present in the foothills.

Lauan has a tall and regular bole, reaching a height nearly equal to that of Hagachac. (Pl. XI.) The average diameter of Lauan trees over 40 centimeters (16 inches) in diameter upon the Hagachac type is 64.88 centimeters (24.42 inches) and upon the Narra type 67.28 centimeters (26.48 inches). The young trees of Lauan are little buttressed, but old trees often have very large ones.

Lauan is tolerant, reproducing in places where there is only a small amount of light. (Pl. XII.) Mature trees stand above the surrounding vegetation, and when very large are sometimes hollow or defective at the heart. Lauan is used in construction and inside work, but does not stand well in contact with the soil, and is often eaten by the white ant.

Guijo (*Shorea guiso*).—This tree (Pl. XIII) occurs over all of the low flat country and on lower hillsides, usually as scattered individuals. It is a tall-growing tree, having a clear length of 20 to 26 meters (65 to 85 feet). It reaches a diameter of 120 centimeters (47 inches.) The average diameter of Guijo trees over 40 centimeters (16 inches) in diameter upon the Hagachac type is 66.4 centimeters (26.26 inches) and on theNarra type 61.99 centimeters (24.4 inches). The tree has small or medium-sized buttresses, though many have no more than a large root swell. In favorable places reproduction is good. The wood of Guijo is moderately heavy and hard, strong, brittle, fairly durable, and usually free from defects. It is a good general-construction timber.

Amuguis (*Koordersiodendron pinnatum*).—In almost all of the moist flats and hillsides Amuguis grows as scattered trees throughout the forest.

Although not so tall growing as Lauan, Guijo, or Hagachac, it usually reaches above most of the surrounding trees, having a clear length of from 12 to 15 meters (39 to 49 feet). The bole is evenly tapered and nearly round in cross section. The average diameter on the Narra type for trees over 40 centimeters (16 inches) is 64.03 centimeters (25.2 inches) and on the Hagachac type 58.2 centimeters (25.16 inches).

While not so tolerant as many of its associates, it nevertheless will grow and reproduce in partially shaded places. Reproduction is usually good. Broken branches are not uncommon, and hollows in the trunks of larger trees are frequently found. Amuguis is a structural wood of medium quality that is fairly strong, brittle, moderately heavy, and hard. It is used in ordinary construction and in cabinetwork. When used for rails on the logging tramway it gave excellent satisfaction, proving to be the best of any timber tried.

Apitong (*Dipterocarpus* sp.).—This tree is found only in the lower half of the Narra type. Apitong has a tall, regular bole (Pl. XIV) and reaches a height of 30 meters (98 feet), with an average diameter for trees over 40 centimeters (16 inches) of 67.8 centimeters (26.69 inches.) The tree is quite tolerant when young, and in favorable places has a good reproduction. It is known locally as Apitong, by which name it is sold upon the market. It very closely resembles the true Apitong (*D. grandiflorus*) and apparently is as good for construction purposes.

Sacat, Calumpit, and Malagabi (*Terminalia* spp.).—The tree species Sacat (*Terminalia nitens*), Calumpit (*T. edulis*), and Malagabi (*T. pellucida*) are too widely scattered to be of any great importance commercially, although they are found over almost all parts of the tract. They are tall growing and usually of large diameter. The average diameter of *Terminalia* trees over 40 centimeters (16 inches) upon the Narra type was 66.44 centimeters (26.15 inches). Reproduction is not plentiful and the trees are evidently quite intolerant of shade.

Dao (*Dracontomelum mangiferum*).—Widely distributed over the whole tract, Dao is the predominant tree in some of the poorer grades of forest and a common one in nearly all. It reaches a height of from 12 to 20 meters (39 to 65 feet) to the lowest branches and a diameter of as much as 150 centimeters (59 inches). The average diameter of trees over 40 centimeters (16 inches) on the Hagachac type is 75 centimeters (30 inches); in the Narra forest, 77.94 centimeters (30.68 inches). It has the largest buttresses of any common tree in the forest. Reproduction is not plentiful, for the tree is intolerant. Although never used, the wood appears to be of good quality. This is the most promising tree which has not been commonly used for lumber purposes.

Malaguibuyo (*Celtis* sp.).—A commonly distributed tree, having an average diameter on the Hagachac type for trees over 40 centimeters (16 inches) of 55.23 centimeters (21.74 inches) and reaching a height of 10 meters (33 feet), this tree may possibly prove to be of value, although it has never yet been used.

Agupanga (*Chisocheton* sp.).—This tree is one of the most widely scattered of any, and seeds and reproduces rapidly. Comparatively low growing, with a spreading top, it nevertheless is quite tolerant of shade. It seldom reaches a large size and probably will never make a valuable commercial wood.

INJURIES TO WHICH THE FOREST IS LIABLE.

Of all the injuries to which the forest is subjected, by far the largest part comes either directly or indirectly as the influence of man. Chief among these are caiñgins and grass-land fires. Forest fires, in the usual acceptance of the term, are unknown.

Caiñgins.—As already mentioned under the description of the Calaanan type, it has long been the custom with the natives to enter the forest and to fell all of the trees upon a certain area at the commencement of the dry season. This area is burned over at the end of the dry season and planted to crops. Such a clearing is called a "caiñgin."

In times past the damage done by these caiñgins has been very great. A consultation of the map will serve to illustrate this. The Calaanan area has been formed in this way from what was probably at one time good forest. The stand and yield tables show the same things. With the exception of the Narra type, which has largely escaped because it is less accessible and lacks an equally good running water supply, the yield of timber has been greatly reduced by the numerous caiñgins made. The loss is much greater near to and upon the foothills of the mountains, where the primitive Mangyans have for a long time worked unrestricted. While the damages has in recent years been largely checked, it still continues.

Under present conditions the demand for caiñgins will probably continue, for they are regarded by the people as a necessary as well as a natural right. This demand may be met by allowing caiñgins to be made upon the Calaanan, and, in exceptional cases, upon the Guipa type. A careful patrol of the tract during the first part of the dry season for the purposes of granting caiñgin permits and to punish those making unauthorized caiñgins will, it is believed, greatly lessen and eventually check this evil.

Grass-land fires.—Practically all of the grass land upon the tract is burned over every spring and summer. In many places this effectually keeps out all the trees and in others does serious injury to the few that are present. In the river bottoms, which are annually flooded by the excessive rains, and upon the pastured grass land near the villages, fires are not so important, since this land will probably continue to remain grass land in any event, but, in other places unaffected by floods, fires have done a great deal of damage. With the present force, and under the present conditions, it will be impracticable to entirely prevent these fires.

Natural causes.—A few trees, especially those growing in the more open places, lose branches or tops from wind, but, as a rule, the damage done from this source is unimportant.

Insects and fungi are destructive mainly to felled timber, and often logs of the poorer kind that are left in the woods for any time are quite seriously attacked by insects or fungi, or by both. To avoid this damage, as well as to prevent the injury of the young growth which might spring up while they were left, these logs should be removed to some dry open place as soon after cutting as possible.

THE UTILIZATION OF THE FOREST.

TIMBER.

History of lumbering.—The license agreement of the Mindoro Lumber and Logging Company is dated June 3, 1905. Table XXI, computed from data taken from the company's books, shows the amount of timber that has been marketed from that time to July 1, 1906.

TABLE XXI.—*Timber sold by the Mindoro Lumber and Logging Company during the year ended June 30, 1906.*

Name.	In the log (round).		Name.	In the log (round).	
	English cubic feet.	Cubic meters.		English cubic feet.	Cubic meters.
Guijo	20,284.04	574.35	Pahutan	189.19	5.36
Narra	8,648.67	244.89	Pili	44.59	1.26
Lauan	5,822.66	164.88	Malugay	52.54	1.49
Apitong	2,612.65	73.97	Ipil	40.20	1.14
Amuguis	1,279.79	36.24	Others	328.68	9.31
Candol-candol	651.37	18.45			
Palo Maria	429.48	12.16	Total	40,560.56	1,148.50
Pagsahiñgin	176.70	5			

Timber sawn on tract by company's sawmill.

	Feet B. M.
Lauan	24,219
Amuguis	10,535
Apitong	5,611
Guijo	5,503
Narra	2,112
Total	47,980

In addition to this, a small amount of timber is still at the mill which, with the amount that has been used for construction purposes on the tract, is approximately equal to the quantity of sawn timber sold.

Previous to July 3, 1905, a number of individuals or companies have from time to time held this tract, or portions of it, together with some adjacent forest. In no case did these concessions coincide with the present one, hence it is impossible to state the exact amount removed from it. It is believed, however, that only a small amount of timber had been cut from the forest south of the Boñgabon River. North of the Boñgabon River a larger number of logs have been taken from the scattered timber lands near the Tidiangan and Sucol rivers. It is stated by the natives that in former times a great many logs had been sold from the barrio of Paclasan from territory now occupied by Calaanan and grass.

Present lumbering operations.—A very primitive method of logging, similar to that employed by native lumbermen, has been used by the present company. The trees are felled and chopped by Filipino laborers into lengths 3 to 6 meters (10 to 20 feet) long. For this work American axes are used, although occasionally saws are substituted. The logs are then loaded upon rude sleds similar to the logging "dray" of the United States, and dragged by a team of from six to eight carabaos to the mill or to some point along the tramway which leads to the beach. The rough trails over which this hauling was done are made by merely cutting away the underbrush. These roads are passable, except at the lowest places, at almost any season of the year. At the tramway the logs are loaded upon small cars drawn by one or two carabaos and hauled one at a time to the beach.

The cost of such operations as this can only be given approximately. Ordinary wages and costs are about as follows:

Manager	per month	₱150.00
Head foreman	do	40.00 to 60.00
Gang foreman	per day	1.00
Choppers	do	.75 to 1.00
Others laborers	do	.50 to .75
Carabao, with driver	do	1.50 to 1.75
Carabao, value	each	100.00 to 150.00

₱2=$1 United States currency.

Two men can fell and cut into logs from two to four medium-sized trees per day, or from 300 to 500 English cubic feet. A team of six to eight carabaos, with a driver for each animal, will haul from three to six logs per day for an average distance of half a mile. Two carabaos and their drivers will haul about four logs per day on the tram car from the mill to the beach, a distance of 1½ miles.

Working upon this rude basis, the cost of cutting and delivering at the beach by the present method will vary from ₱0.07 to ₱0.13 per English cubic foot, depending greatly upon the length of haul, management, and kind of timber cut. Counting an English cubic foot equivalent to 7.2 feet B. M.,[a] this would be a cost of from ₱9.75 to ₱18 per 1,000 board feet. Contracts are sometimes made to cut and deliver logs to the beach when the average distance is one-half mile at the rate of ₱2 per average log of 40 or 50 cubic feet, the contractor being supplied with carabaos by the owner. This would mean about ₱6 per M feet B. M. in addition to the rental of the carabaos. In other cases, the contractor supplies his own carabaos and received from ₱0.08 to ₱0.10 per English cubic foot, or about ₱12 per M feet B. M. for logs delivered on the beach.

The present cost of logging could be greatly reduced by more careful organization and by providing cheaper methods of transporting the logs from the forest to the beach, which is by far the largest single item of expense. To do this it is suggested that iron rails be used upon the tramway, instead of wooden ones. This would permit the hauling of several logs instead of one at a time, would avoid breakage of rails and cars, and would greatly reduce the draft, thus permitting more trips per day. It is also suggested that wide-tired, two-wheeled logging carts be tried instead of the logging sled. These have a lighter draft, and, where tried in other parts of the islands, have given excellent satisfaction. A steam logging and skidding outfit, including two donkey engines and 2 miles of cable, could be used upon the tract and would greatly reduce the cost of logging.

A portable sawmill, having a capacity of about 10,000 feet B. M. per day, has been placed upon the tract. Owing to difficulties incident to the installation of this mill, it has not yet been operated sufficiently to allow any estimate of the cost of running.

In addition to the regular logging operations, the present company has cut a number of table tops from the large flat buttresses of Narra trees. These can be removed with saws and axes and can be secured up to 6 feet in diameter. Usually the buttresses vary from 4 to 12 inches in thickness, and may be hewed to an even thickness of about 3 inches. One of these tops, which measured 6 feet in diameter and 3 inches in thickness, was removed under the direction of the field party at a cost of a little less than than ₱18. In this case, the men were hired for this work alone. With a regular organized force, the cost should be reduced about one-half.

Markets and transportation.—Practically all of the logs and lumber is sent to Manila by means of steamers or sailboats. The cost of shipment from the tract to Manila (distance 200 miles) varies from ₱0.18 to ₱0.25 per English cubic foot, which would be, counting an English cubic foot equal to 7.2 feet B. M., ₱25 to ₱34.72 per M feet B. M. The cost of transportation is slightly less upon sailing vessels than upon steamers. The logs are floated to the ships, which, on account of the shallow water, are required to anchor nearly one-quarter of a mile from shore. The regular charge for this is ₱0.50 per log, which amounts to about ₱0.01 per English cubic foot, or ₱1.39 per M feet B. M. Weather conditions are an important factor to be considered in connection with transportation. Sometimes storms delay loading, hinder transit, or affect the shipper very seriously in a number of ways.

The following are the average prices now paid in Manila for logs and for sawn timber:

Name.	Per English cubic foot in the log.	Per Spanish cubic foot in the log.	Per M feet B. M., sawn timber.	Stumpage charges per M feet B. M. (United States currency).
Yellow Narra	₱0.92–₱1.05	₱0.70–₱0.80	₱225–₱275	$5.00
Hagachac	.46– .48	.35– .37	90– 115	1.00
Lauan	.39– .46	.30– .35	70– 90	1.00
Amuguis	.52– .98	.40– .75	110– 150	2.00
Guijo	.65– .85	.50– .65	98– 140	3.00
Apitong	.46– .48	.35 .37	90– 115	2.00
Sacat	.52– .98	.40– .75	100– 150	2.00

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[a] Measurements made by the Gibson's Saw and Planing Mills Company upon a few Narra logs that were sawn with a band saw showed the following facts: Forty-three logs, containing 41.81 cubic meters (1,476.58 English cubic feet), yielded 15,199 feet B. M. of lumber not edged. Allowing for a waste in edging of 20 per cent, this would be a yield of 290.81 feet B. M. per cubic meter, or 8.24 feet B. M. per cubic foot. The above factor of 7.2 feet B. M. per cubic foot is therefore conservative.

Financial results and prospects.—Summarized, the cost, exclusive of taxes or stumpage charges of logging and delivery in Manila, should not exceed the following:

	Per English cubic foot.
Cutting and delivering on the beach	₱0.07 to ₱0.13
Loading upon shipboard	.01 to .01
Shipping to Manila	.18 to [a].25
Wages of officials, breakage, etc	.02 to .02
Total	.28 to .41

This cost, as with the calculations throughout, is estimated regardless of the groups to which the logs belong. As a matter of fact, it costs slightly more to remove Narra than other kinds of timber, for the trees are lower growing and the logs harder to handle on account of their angular shape. With the other kinds of timber there is but little difference in the cost of handling.

Taking into account the stumpage charges, the cost of delivery, and the selling prices, it will be seen that there is an excellent profit to be made upon the higher-group timbers, and a fair one upon all, even with the primitive methods in use. With improved methods and equipment, the cost should be so reduced that an assured profit could be made upon all timber taken from the forest.

MINOR PRODUCTS.

Firewood.—Almost all the trees which compose the thick mangrove swamps of the coast make an excellent firewood. Firewood is commonly cut into two general sizes. The small sizes, called "leñas," are less than 2 feet in length and 3 inches in thickness. The other size, known as "rajas," are about 5 feet in length and not over 6 inches in thickness. It costs from ₱6 to ₱9 to gather 1,000 rajas, while the Manila price varies from ₱20 to ₱50. The market prices and cost of gathering leñas is correspondingly less. The forest tax on rajas is ₱1 per 1,000 feet and on leñas ₱0.10 per cubic meter. As yet but little firewood has been cut from this tract, although the supply is very large.

Tan barks and dye barks.—The bark of a number of the mangrove-swamp trees is valuable both for tanning and dyeing. As previously stated, the general terms of Bacauan (Bacao) and Tan̄gal are applied to many species of the *Rhizophoraceæ*. Another species, Tabigue, produces a good quality of dye bark and is very common. Tan bark and dye bark are generally sold in bundles composed of pieces 3 feet long and 3 or 4 inches wide, weighing 1 picul (139.4 English pounds). The Manila price is about ₱2 per picul, while the local selling price is about ₱0.75 per picul.

Bejucos.—Large quantities of bejuco, or rattan, are found in the forest. These vary considerably in value, the smaller ones being usually the best. These are usually cut into lengths 6 meters long and tied into bundles of from 50 to 100 pieces each. One man with a bolo can cut and prepare in one day about 6 bundles of 50 pieces each.

Other minor products.—The leaves of the Nipa palm are very commonly used locally for roofing and thatching, but as yet little has been marketed.

The young leaves of the Buri palm are gathered just before they open, spread out in the sun, and allowed to wilt for about two days. They are then made into rolls, each about 1 foot in diameter and 2 inches thick, and used for making baskets, hats, mats, etc. The market for this product is as yet but little developed. The local selling price is ₱2.50 for 100 rolls.

The sap of the Pili and Pagsahin̄gin is gathered after slashing the trees with a bolo and leaving the resin until it hardens. It is then made into torches of convenient size by wrapping in Anahao leaves. These are commonly used by the natives for lights, and sold locally for ₱0.02 each. The resin of Pili has the market name of Manila Elemi, and is a commercial product from some portions of the islands.

A number of vines, classed under the general name of Gogo, are gathered in pieces about 1 meter long, and sold locally for ₱3.50 per 100 pieces. These are pounded into a pulp and used as a soap for washing the hair. The principal species which produces this product is *Entada scandens* Benth.

A number of vines under the general name of Diliman are gathered and used in tying fish traps and other similar articles. The fruit of the Bongan gubat palm (a wild betel nut) is chewed by the natives very generally. The heart of the Yroc palm is commonly used for food, and has a taste very much like fresh cabbage. A flour called "Yuro" is also made from this palm. The leaves of the Yroc palm make excellent brooms, and are much used locally. Many other less important minor products are secured by the natives, and are locally of value.

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[a] These figures, obtained from shippers, are thought to be high.

AGRICULTURAL POSSIBILITIES.

The soil over the larger part of the tract is well adapted to agricultural purposes. Table XXII contains a summary of the analyses of twenty-three soil samples taken from twelve widely separated places on the flat portion of the tract.

Table XXII.—*Chemical analysis of soil.*[a]

Sample.	Number of samples taken.	Loss on ignition.	CaO.	P_2O.	N.	K_2O.	Na_2O.	Fine earth through 40 mesh.
Surface to 20 centimeters (8 inches)	9	8.08	0.50	0.10	0.25	0.53	0.16	94.9
Subsoil from 20 to 120 centimeters (8 to 47 inches)	9	3.79	.48	.06	.06	.33	.25	95.9
Subsoil below 120 centimeters (47 inches)	5	3.73	1.01	.03	.03	.26	.21	91.1

[a] By L. A. Salinger, chemist, bureau of science, Manila, P. I.

While too much reliance should not be placed upon any chemical analysis of soils as an indication of their fertility, it is to be noted that the amount of nitrogen (N), phosphoric acid (P_2O), and potash (K_2O) found here is sufficient, under ordinary conditions, to supply the needs of plant growth, and compares favorably with analyses from other places. The vegetation, both cultivated and wild, is everywhere rank and dense, indicating that a sufficient quantity of this plant food is in an available form.

With few minor exceptions, the soil over the whole tract resembles quite closely that of the samples taken. Usually, the surface soil is from 5 to 25 centimeters (2 to 10 inches) in depth and contains a considerable amount of humus. A clay or sandy clay subsoil reaches to a depth of from 75 to 200 centimeters (28 to 78 inches). Below this no investigations were made.

Of equal importance is the question of rainfall and drainage. As already stated, the rainfall in this place is well distributed throughout the year. At no time during the dry season, while field work for this report was being done, was the soil dry, except at the surface in exposed situations or in pure sand or gravel. There is in most places a sufficient quantity of sand mixed with the clay to allow for drainage.

Probably the most suitable crop is Manila hemp or abaca. Considerable quantities of this have already been planted. In the foothills cacao is raised by the Mangyanes with success. Cocoanuts, rice, sugar cane, tobacco, corn, and various vegetables are the other principal crops.

Part II.

FUTURE MANAGEMENT.

BASIS OF PROPOSALS

RELATION BETWEEN OWNER AND LICENSEE.

The public forest on this tract is owned by the Philippine government and is in the charge of the bureau of forestry. It is held by the Mindoro Lumber and Logging Company under a twenty-year license agreement. This agreement grants them the exclusive right to cut, collect, and remove timber, firewood, and bejuco on the condition that they make use of their license privilege, pay the regular government charges on the products taken, and follow the bureau of forestry rules and regulations for gathering them.

It is important to the licensee, as well as to the bureau of forestry, that provision be made for a future yield from the tract.

SUMMARY OF STAND AND YIELD.

A review of Tables VI, VII, VIII, and IX shows that the heaviest stands are upon the Narra tract, with that upon the Hagachac type next. Of the timber trees, Lauan stands first, 46 per cent of the total yield; Hagachac second, 17 per cent; Guijo third, 13 per cent; Amuguis fourth, 11 per cent; Narra and Apitong, about 4½ per cent each, and *Terminalia* sp. less than 4 per cent.

It is thus noted that while the cheaper timber predominates, the total quantity of Guijo, Amuguis, and Narra constitute 28 per cent of the whole.

Altogether, the total yield of timber trees over 50 centimeters (20 inches) in diameter from the 11,339 acres estimated, is 95,856,175 feet B. M. If the sawmill were run at its full capacity of 10,000 feet B. M. per day, this amount, which includes only the seven species now being cut, is sufficient to last thirty-two years of 300 working days each. In addition to these kinds, there are a great many large trees of other species, some of accepted commercial value, which would no doubt be utilized by any permanently located lumber company. By the time the present stand is removed the poles and trees under 50 centimeters (20 inches) would in all probability supply a second crop.

METHOD OF TREATMENT.

OBJECT TO BE ATTAINED.

The object in view for the commercial forest area is (1) to regulate the cutting of timber in such a manner that the mature trees, together with such others as is consistent with good management, may be removed from the forest as soon as possible; and (2) to retain in the forest the young stock, and, if necessary, seed trees, and to assist natural reproduction so that future crops can be provided for.

The object in view for the noncommercial forest is (1) to supply the demand for agricultural lands, either as caiñgins or in some other form; and (2) to convert as much as possible of the Guipa type into commercial forests.

METHOD OF TREATMENT ADOPTED.

Owing to the lack of definite knowledge of the age of trees and of their habits of growth, and to the conditions under which this plan must be put into operation, the selection system of felling is the one which will be used for the commercial forest. The fellings should be so regulated as to remove all old and overmature trees, to protect the young growth, and to aid in every possible way natural regeneration.

EXPLOITABLE SIZE.

Since there are a large number of mature and overmature trees in the commercial forest which should be cut as soon as possible, the exploitable size of the trees has been fixed at 50 centimeters (20 inches) in diameter. Trees below that diameter should only be cut when marked by the forester in charge, and then only when the mature trees have been removed or when an especially heavy stand will admit of thinning.

Table XXIII, compiled from the stand tables previously given, shows the number of trees over 50 centimeters (20 inches) in diameter, compared with the number from 10 centimeters (4 inches) to 50 centimeters (20 inches) in diameter.

TABLE XXIII.—*Summary of stand of principal trees per acre.*

Species.	Narra type.			Hagachac type.		
	Diameter.			Diameter.		
	10–50 centimeters (4–20 inches).	Over 50 centimeters (20 inches).	Total.	10–50 centimeters (4–20 inches).	Over 50 centimeters (20 inches).	Total.
Narra	1.153	1.803	2.956	0.087	0.201	0.288
Lauan	8.537	4.698	13.235	4.719	3.538	8.257
Guijo	3.035	1.190	4.225	1.725	1.064	2.789
Hagachac	.411	.126	.537	6.159	3.106	9.265
Amuguis	1.994	1.619	3.613	1.726	1.122	2.848
Apitong	2.008	.836	2.844	.143	.057	.200
Malagabi Sacat Calumpit	.497	.436	.933	.546	.230	.776
Total	17.635	10.708	28.343	15.105	9.318	24.423

LOGGING.

Cutting areas.—Cutting areas should conform as nearly as possible to the wishes of the licensee. When, however, cuttings shall have been started from any one base and over an area approved by the forester in charge, it shall not be carried on outside of that area without the consent of the forester in charge or of the Director of Forestry.

For the present, logging operations should be continued from the present base until the north end of the Narra and adjacent parts of the Hagachac types shall have been cut over. Operations should then be started from the Dungay River as a base and a tramway extended back through the south end of the Narra type and the narrow strip of Hagachac adjoining it. The work upon this being completed, the remainder of the Narra and of the Hagachac I forests should be logged. Next, the tract designated on the map as Hagachac II should be cut, and, last of all, the mixed forest. In every case cutting on one part should be finished before it is commenced on the next. Thus a very primitive rotation is established, and, by the time the last area is cut over, the large poles and younger trees left upon the first part worked should be ready for a second crop.

Cutting rules.—(1) Felling of trees shall be permitted only over such areas as are approved by the forester in charge or by the Director of Forestry. In assigning cutting areas the forester shall follow as nearly as possible the plan suggested in the paragraph headed "Cutting areas."

(2) No Narra trees shall be felled except those marked by the district forester.

(3) No timber trees shall be felled which are less than 50 centimeters (20 inches) in diameter at breast height or, in cases of trees having buttresses at the lowest place, above the buttress swell, unless marked by the district forester.

(4) In cutting marked timber the marks upon the stumps shall not be destroyed or effaced.

(5) Trees shall not be cut higher above ground than the diameter of the tree, except in cases of trees having buttresses, which may be cut above the highest buttress.

(6) Buttresses shall not be cut for table tops or for any other purpose from any living tree.

(7) All merchantable timber shall be removed from the forest within two months from time of felling and placed upon some suitable skidway or landing.

(8) The licensee shall be held responsible for the destruction of, or serious injury to, young timber trees by careless felling and for all merchantable timber left in the woods.

(9) No Narra, Lauan, Amuguis, Guijo, Hagachac, Apitong, or other trees of equal value shall be used for the construction of roads or skidways.

(10) Minor species may be cut and used for the construction of roads, skidways, etc., without charge.

(11) None of these special rules shall be construed to excuse the licensee from the regular bureau of forestry rules and regulations or from the terms of the license agreement.

SUPPLEMENTARY RECOMMENDATIONS.

GENERAL MANAGEMENT.

All timber trees marked by the district forester shall be stamped in at least two places with the regulation marking hatchet in addition to such other distinctive marks as he may see fit to use. These marks shall be placed below where the tree is to be cut in felling.

If a reasonable advantage is not taken of the privilege to gather firewood and bejuco by June 30, 1907, the exclusive right to remove these products should be taken from the company and licenses to gather said products granted to such other party or parties as may apply for them.

PROTECTION.

Since the proper protection of the forest depends so much upon the attitude of the local inhabitants, every legitimate effort should be made by the forest officers to gain their confidence and cooperation.

A forest officer should go over the entire tract at the beginning of the dry season and see that all persons desiring caiñgin permits be granted them if they can not be persuaded to make homestead applications. The local inhabitants look upon the making of caiñgins as a natural right. Hence, it is deemed preferable to attempt to regulate caiñgins than to forbid them entirely. Every effort should be made to encourage the taking of homesteads and the occupying of permanent farms. Inspection should be made during the caiñgin season to locate and punish all persons violating the caiñgin law.

At present it will be impracticable to prevent the annual fires which burn over the grass lands, although forest officers should make every effort to gain the cooperation of the local inhabitants in preventing damage from this source.

REVISION.

As additional information is gained from time to time, the plan of management should be revised whenever such a revision will add to its effectiveness. A careful examination should be made of the tract south of the Baroc River and west of the small Uasig River some time within the next five years.

ADMINISTRATION.

The chief of the forest district in which the tract lies shall have charge of the administration of this working plan. He shall be assisted by such other forest officers who are under his direction as he shall assign to this work.

The district chief, or a subordinate, shall make trips of inspection to the tract whenever it is necessary to mark timber or to perform other duties. In addition to these periodic inspections, a forest ranger shall be placed upon the tract for such time as may be necessary during the caiñgin season to grant caiñgin permits, to prevent illegal caiñgins, and to perform such other duties as may arise regarding the regulation of caiñgins, as well as to report upon any special subject which the district forester may direct.

In cases of violation of the forest act or rules and regulations of the bureau, either by the licensee or by any other persons or persons, the forester in charge shall take the matter up with the offending parties in the manner authorized by law for such cases. He shall then report the facts to the Director of Forestry. The forester in charge shall render a special report of work done upon the tract at the end of each fiscal year.

SUMMARY.

(1) Practically all of the commercial forest on the tract examined lies south of the Boñgabon River.

(2) Narra is confined to a belt of forest varying from one-half to 2 miles in width immediately back of the tidal swamp.

(3) The timber on the foothills at the back part of the tract has been greatly diminished in value and in some places almost entirely destroyed by Mangyan clearings.

(4) The flat land of the tract is, for the most part, suited for agricultural purposes and will no doubt be eventually so used.

(5) The land south of the Boñgabon River, which contains commercial or Guipa types of forest, should be made to produce a second crop. The land north of the Boñgabon River will probably not be reforested, except a part of the Guipa type, but will be used for agricultural purposes.

(6) Caiñgin permits should be granted only upon the Calaanan land, after a personal inspection by a forest officer.

(7) The greatest source of expense in present lumbering operations is transportation. This could be reduced by providing a more permanent tramway, by installing a donkey engine and cable, or by using big-wheeled logging carts.

APPENDIX.

LIST OF PLANTS.

The first of the following tables is a list of tree species found on the tract that reach the size of 30 centimeters or over in diameter. The second list comprises all other species mentioned in the text, and includes some trees that are below 30 centimeters in diameter when mature. The first list of 88 tree species is fairly complete. In the second list no attempt has been made to enumerate all species under this size found in the forest. Compared with the *Dipterocarp* forest of northern Negros,[a] the floristic composition of this forest is very complex.

The scientific nomenclature used in this paper is based on collections made by the authors and deposited in the herbarium of the Bureau of Science. They wish to thank Elmer D. Merrill for assistance in the determinations.

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[a] See Everett, H. D., and Whitford, H. N.: A Preliminary Working Plan for the Public Forest Tract of the Insular Lumber Company, Negros Occidental, P. I., *Bur. For. Bull. No. 5*, 1906.

Tree species 30 centimeters and over in diameter when mature.

Scientific name.	Family.	Local name.	Commercial name.
Actinodaphne philippinensis Merr	Lauraceæ	Bacan	
Alangium meyeri Merr	Cornaceæ		
Alstonia macrophylla Wall	Apocynaceæ		Batino.
Artocarpus communis Forst	Moraceæ	Antipolo	Antipolo.
Avicennia officinalis L	Verbenaceæ	Apiapi	
Barringtonia luzonensis Vid	Lecythidaceæ	Putat	
Barringtonia racemosa Bl	do	do	
Barringtonia reticulata Miq	do	do	
Barringtonia speciosa Forst	do	Botong	
Bischofia trifoliata Hook	Euphorbiaceæ	Toog	
Buchanania nitida Engl	Anacardiaceæ		
Canangium odoratum Baill	Anonaceæ	Alangilang	Ylang ylang.
Canarium luzonicum A. Gray	Burseraceæ	Pili	Pili.
Canarium perkinsae Merr	do		
Canarium radlkoferi Perk	do		
Canarium villosum Bl	do	Palsahiñgin	Pagsahiñgin.
Calophyllum inophyllum L	Guttiferæ	Palomaria	Palomaria de la playa.
Carallia integerrima DC	Rhizophoracæ	Bacauan gubat	
Casuarina equisetifolia Forst	Casuarinaceæ	Agoho	Agoho.
Celtis sp	Ulmaceæ	Malaguibuyo	
Champereia cumingiana Merr	Opiliaceæ		
Chisochiton tetrapetalus Harms	Meliaceæ		
Chisocheton sp	do	Agupanga	
Cryptocarya acuminata Merr	Lauraceæ	Malabacauan	
Dehaasia triandra Merr	do	Baslayan	
Dillenia philippinensis Rolfe	Dilleniaceæ	Catmon	Catmon.
Diospyros pilosanthera Bl	Ebenaceæ	Bolongeta	Bolongeta.
Dipterocarpus lasiopodus Perk	Diptocarpaceæ	Hagachac	Apitong.
Dipterocarpus sp	do	Apitong	Do.
Dracontomelum mangiferum Bl	Anacardiaceæ	Dao	Dao.
Dracontomelum sp	do	Malugay	Malugay.
Elaeocarpus oblongus Gaertn	Elaeocarpaceæ		
Endiandra coriacea Merr	Lauraceæ	Palusat saling	
Erythrina indica Lam	Leguminosæ	Dapdap	
Eugenia bordenii Merr	Myrtaceæ		
Eugenia sp	do		
Euphoria cinerea Radlk	Sapindaceæ	Alupay	Alupay.
Fagara integrifolia Merr	Rutaceæ	Salay	
Ficus barnesii Merr	Moraceæ	Tibig	
Ficus nota Merr	do	do	
Ficus minahassæ Miq	do	Hagaimit	
Ficus variegata Merr	do	Tangisang bayauac.	
Ficus sp	do	Balete	
Gonystylus bancanus Gilg	Gonystylaceæ	Talimadon	
Grewia stylocarpa Warb	Tiliaceæ		
Heritiera littoralis Dry	Sterculiaceæ	Dungon-late	Dungon-late.
Horsfieldia ardisifolia Warb	Myristaceæ	Duguan	
Horsfieldia merrillii Warb	do	do	
Intsia acuminata Merr	Leguminosæ	Tindalo	Tindalo.
Kayea paniculata Merr	Guttifereæ		
Koordersiodendron pinnatum Merr	Anacardiaceæ	Amuguis	Amuguis.
Lauraceæ indet	Lauraceæ	Punghan	
Litsea perrottetii F. Vill	do	Bacan	
Litsea sp	do	Busising cahoy	
Macaranga bicolor Muell	Euphorbiaceæ	Tabong	
Macaranga tanarius Muell	do	Binunga	
Mallotus barnesii Merr	do		
Mangifera altissima Blanco	Anacardiaceæ	Pahutan	
Myristica philippinensis Lam	Myristicaceæ	Duguan	
Neolitsea vidalii Merr	Lauraceæ	Lanotan puti	
Octomeles sumatrana Miq	Datisaceæ	Binuang	
Palaquium luzoniense Vid	Sapotaceæ	Nato	
Parkia roxburghii G. Don	Leguminosæ	Cupang	Cupang.
Pisonia umbellata Seem	Nyctaginaceæ	Anuling	
Pithecolobium lobatum Benth	Leguminosæ	Bansilac	Anagap.
Pterocarpus indicus Willd	do	Narra	Yellow Narra.
Pterosperumu niveum Vid	Sterculiacæ	Bayog	
Pterocymbium tinctorium Merr	do	Taloto	Taloto.
Pygeum latifolium Miq	Rosaceæ		
Radermachera banaibana Seem	Bignoniaceæ	Banaibanai	
Sarcocephalus cordatus Miq	Rubiaceæ	Bancal	Bancal.
Shorea contorta Vidal	Dipterocarpaceæ	Lauan	Lauan.
Shorea guiso Bl	do	Guijo	Guijo.
Sonneratia pagatpat Blco	Sonneratiaceæ	Pagatpat	Pagatpat.
Sterculia blancoi Rolfe	Sterculiaceæ	Candol-candol	Candol-candol.
Sterculia foetida L	do	Calumpang	
Sterculia philippinensis Merr	do	Banilad	
Stylocoryne macrophylla Bartl	Rubiaceæ	Basa	
Terminalia catappa L	Combreteceæ	Talisay	Talisay.
Terminalia edulis Bl	do	Calumpit	Calumpit.

Tree species 30 centimeters and over in diameter when mature—Continued.

Scientific name.	Family.	Local name.	Commercial name.
Terminalia nitens Presl	Combretaceæ	Malaruhat	Sacat.
Terminalia pellucida Presl	do	Malagabi	
Toona sp	Meliaceæ	Calantas	Calantas.
Trewia ambigua Merr	Euphorbiaceæ		
Xylocarpus granatus Koenig	Meliaceæ	Tabigue	
Xylocarpus obovatus Juss	do	do	
Xylopia dehiscens Merr	Anonaceæ		

Other species mentioned in the text.

Scientific name.	Family.	Local name.	Commercial name.
Acanthus ilicifolius L	Acanthaceæ	Doloarin	
Achrostichum aureum L	Polypodiaceæ	Lagolo	
Areca whitfordii Becc	Palmæ	Bongan gubat	
Arenga saccharifera Labill	do	Yroc	
Bruguiera gymnorrhiza Lam	Rhizophoraceæ	Pototan	Bacauan.
B. caryophylliodes Bl	do	Liray	
B. eriopetala W. and A	do	Pototan Busian	
B. parviflora W. and A	do	Jangalai	Hangaray.
Callicarpa blancoi Rolfe	Verbenaceæ		
Callicarpa erioclona Schauer	do		
Callicarpa formosona Rolfe	do		
Caryota sp	Palmæ	Pugahan	
Ceriops candolleana Arn	Rhizophoraceæ	Tangal	Tangal.
Ceriops roxburghiana Arn	do	do	
Clerodendron macrostegium Sch	Verbenaceæ		
Corypha umbraculifera L	Palmæ	Buri	
Cycas circinalis L	Cycadaceæ	Bitogo	
Cyclostemon microphyllus Merr	Euphorbiaceæ	Butong manoc	
Entada scandens Benth	Leguminosæ	Gogo	Gogo.
Ficus hauili Blanco	Moraceæ	Hauili	
Ficus banesii Merr	do	Tibig	
Ficus mindorensis Merr			
Heterospathe elata Scheff	Palmæ	Sagasi	
Hibiscus tiliaceous L	Malvaceæ	Balabago	
Imperate exaltata Brongn	Gramineæ	Cogon	
Laportea meyeniana Ward	Urticaceæ	Lipa	
Livistona sp	Palmæ	Anahao	Palma brava.
Macaranga hispida Muell	Euphorbiaceæ	Hamindan	
Mallotus floribundus Muell	do	Tula-tula	
Mallotus moluccanus Muell	do	Alom	
Mallotus playfairii Hemsl	do		
Mallotus ricinoides Muell	do		
Mussænda grandiflora Rolfe	Rubiaceæ		
Nipa fruticans Wurmb	Palmæ	Nipa	Nipa.
Pandanus tectorius Sol	Pandanaceæ	Pandan	
Phæanthus cumingii Miq	Anonaceæ	Lanotan	
Phragmites sp	Gramineæ	Tagpo	
Pinanga insignis Becc	Palmæ	Sarauag	
Rhizophora mucronata Lam	Rhizophoraceæ	Bacauan	Bacauan.
R. conjugata L	do	do	Do.
Saccharum spontaneum L	Gramineæ	Talahib	
Scyphiphora hydrophyllacea Gaertn	Rubiaceæ	Nilad	
Trema amboinense Bl	Ulmaceæ		
Voacanga cumingii Rolfe	Apocynaceæ		

BUREAU OF FORESTRY.

(Circular No. 1.)

OPPORTUNITIES FOR LUMBERING IN THE PHILIPPINE ISLANDS.

MANILA, P. I., *December 1, 1906.*

OWNERSHIP OF FORESTS.

The Philippine public forests cover an area of more than 40,000,000 acres. Less than half a million acres of forest are held by private owners. Under an act of Congress in 1902 the Philippine forests can not be sold, leased, or homesteaded unless the same are more valuable for agriculture than for forest purposes.

LICENSES TO EXPLOIT THE PUBLIC FORESTS.

Exclusive licenses may be granted for terms up to twenty years. These give the holders sole right to exploit certain forest products. The extent of the territory thus granted depends upon the size of the plant to be installed. No charge is made for such a license, and only stumpage charges are imposed. These charges range from ₱0.50 to ₱2.50 per cubic meter, or approximately from $1 to $5 (United States currency) per thousand feet B. M. Such an arrangement is preferable to buying the land, since no land taxes are incurred. There are a number of desirable tracts of public forest of large extent now unexploited.

TARIFF RATES.

There are no export duties on timber or on the manufactured product. Logs imported into the United States are admitted free. The import duty at Manila on sawmill and logging machinery is 5 per cent ad valorem.

FREIGHT RATES TO MARKET.

Freight rates from Manila to the Pacific coast amount to $7 (United States currency) per ton (logs), about 40 cubic feet, or $12 to $14 per thousand feet B. M. Freight rates from Manila to the Atlantic coast of the United States are $14 to $15 (United States currency) per thousand feet B. M., or $8 per ton of 40 cubic feet; light-weight material, $5 per 40 cubic feet.

Distances to market.

Distance from—	Manila, P. I.	Cebu, P. I.	Iloilo, P. I.	Hongkong, China.	Shanghai, China.	Sydney, Australia.
	Miles.	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*
Seattle, U. S. A.	6,400			6,300	6,200	6,800
Cadiz, Negros Occidental	400	140	70	800	1,300	3,370
Bongabon, Mindoro	200			700	1,200	3,570

CONSUMPTION OF LUMBER.

	Board feet.
Amount of lumber used in the Philippine Islands per year, approximately	100,000,000
Amount of American pine used in China during the past year	85,000,000
Amount of American pine used in Australia during the past year	63,000,000

PHILIPPINE TIMBERS.

In Bulletin No. 4 of the bureau of forestry thirty common Philippine timbers are discussed. In this bulletin extensive tests show the qualities of the timbers. There is also a brief description of the different woods. Common Philippine timber as good as American pine can be laid down at tide water for about the same price as pine on the Pacific coast. Difference in freight rates, low stumpage, and cheap labor should combine to make a low rate on the manufactured Philippine product in the Chinese and Australian markets and should gradually replace the American product.

STAND OF TIMBER.

In Bulletins Nos. 5 and 6 can be obtained the actual stand of timber on tracts in Negros and Mindoro. These show 10,000 to 32,000 board feet per acre. The lower slopes of Mount Silay in northern Negros are practically covered with merchantable timber. One block of this forest, 69 square miles in area, shows a stand of 32,050 board feet per acre of merchantable timber over 20 inches in diameter. A large area of similar forest on Mount Silay adjoins this tract and awaits the lumberman. In the southwestern part of this province (Negros Occidental) is a large area of valuable forest which will be close to the southern terminus of the new railway.

There are a number of regions in these islands where dense forests of valuable timber are found which have never been exploited for the market. The Agusan Valley, in Mindanao, 4,000 square miles in area, is almost entirely covered with virgin forest and drained by large streams. The dense forests on the east coast of Mindanao are also unexploited.

LABOR PROBLEM.

Labor is not difficult to secure. The wages range from ₱0.50 to ₱1.50 ($0.25 to $0.75, United States currency) per day. Filipinos are apt at handling machines of all kinds and work satisfactorily when treated with consideration. Skilled American loggers and lumbermen, assisted by Filipino crews, should get out logs and manufactured material at prices not far from those quoted for pine on the Pacific coast, especially in regions where we find 30,000 board feet of merchantable timber on each acre close to tide water, and where no special logging difficulties are encountered.

LOGGING.

Logging is carried on during the entire year in many provinces. In some places logging is suspended during the seasons of heaviest rains, a period of from two to four months. The logging methods are very crude.

Many of the native woods will float, and, if handled by the expert raftsmen of the Pacific coast, could be rafted 200 to 600 miles through the quiet inland seas to Manila, and possibly to China, which is about 660 miles from Manila. Not one of the lumber companies of the Pacific coast is actively interested in exploiting the Philippine forests.

LUMBER DEALERS.

The leading lumber dealers in the Philippine Islands are: John Gibson, Insular Lumber Company, Cadwallader & Co., Philippine Lumber and Development Company, Tuason & Sampedro, California-Manila Lumber and Commercial Company.

The offices of these companies are in Manila. For discussion of sawmills see Bulletin No. 4.

CAPITAL NECESSARY TO ESTABLISH LUMBERING OPERATIONS.

The question is often asked, "What capital is necessary to carry on a successful lumbering enterprise in the Philippines?" Such an enterprise should not be attempted unless the company intends to handle the product from start to finish, including transportation, lumber yards at the principal markets, supply stores for use of employees in the forest, etc. This would probably involve the employment of not less than $200,000 (United States currency). A company contemplating logging operations should send a practical logger to look over the ground with an officer of the bureau of forestry.

SUMMARY OF LUMBERING POSSIBILITIES ON ONE TRACT OF PUBLIC FOREST IN NEGROS OCCIDENTAL.

In Bulletin No. 5 of the bureau of forestry a description is given of the forests and lumbering operations near Cadiz, Negros Occidental. The summary of this bulletin is as follows:

Area of tract, 69 square miles; area in forest, 37,668 acres.

Stumpage charges on this tract are collected on manufactured lumber and average less than $1.20 (United States currency) per thousand feet B. M.

Six tree species constitute about 90 per cent of the total stand of merchantable timber on the entire tract.

Amount and value of merchantable timber on tract over 20 inches in diameter.

Species.	Stumpage charge, M feet B. M. (approximate).	Feet B. M. per acre.	Total yield, M feet B. M.	Manila price, M feet B. M.	Value per acre.	Total value.
Apitong	₱4	5,140	193,572	₱90–₱115	₱460	₱17,421,480
Almon	2	7,150	269,269	70– 90	500	18,848,830
Balacbacan	4	4,640	174,742	70– 90	325	12,231,940
Mangachapuy (Red Lauan)	2	13,240	498,618	70– 90	925	34,903,260
Lauan-bagtican and Lauan-dunlog	2	1,880	70,801	70– 90	130	4,956,070
Total	....	32,050	1,207,002	....	2,340	88,361,580

₱2 equals $1, United States currency.

SUMMARY OF LUMBERING POSSIBILITIES ON ONE TRACT OF PUBLIC FOREST IN MINDORO.

In Bulletin No. 6 of the bureau of forestry a description is given of the forest and lumbering possibilities of one tract on the east coast of Mindoro. The summary of this bulletin is as follows:

Area of tract, approximately 85 square miles; area of tract surveyed, 55 square miles; area of part of commercial forest (measured), 11,339 acres (not including mangrove swamps).

Stumpage charges on this tract average less than $2 (United States currency) per thousand board feet.

Seven merchantable tree species constitute about 50 per cent of the total stand on this tract.

Amount and value of merchantable timber on 11,339 acres of forest (trees over 16 inches in diameter).

Species.	Stumpage charge per M feet B. M. (approximate).	Yield M feet B. M.	Manila price.	Total value at lower prices.
Narra	₱10	4,534	₱225–₱275	₱1,020,150
Hagachac	2	17,285	90– 115	1,555,650
Lauan	2	46,464	70– 90	3,252,480
Amuguis	4	11,378	110– 150	1,251,580
Guijo	6	13,973	98– 140	1,368,354
Apitong	4	4,174	90– 115	375,660
Sacat	4	3,429	100– 150	342,900
Total	....	101,237	....	9,166,724

A total yield of 101,237,000 feet B. M. on 11,339 acres, or about 9,000 feet B. M. per acre. Lumber worth ₱810 per acre.

AID FROM THE BUREAU OF FORESTRY.

A study of Bulletins Nos. 5 and 6 of this bureau will indicate to the lumbermen what the bureau will do for them. Forest officers will use every effort to make such propositions succeed financially. Upon request samples of wood may be obtained at the office of the bureau of forestry.

GEORGE P. AHERN, *Director of Forestry.*

BULLETINS

ON

GEOLOGICAL RECONNAISSANCES OF THE IRON REGION OF ANGAT, BULACAN, AND MANCAYAN-SUYOC MINERAL REGION, LEPANTO.

MINING BUREAU.

(Bulletin No. 3.)

REPORT ON A GEOLOGICAL RECONNAISSANCE OF THE IRON REGION OF ANGAT, BULACAN.[a]

By H. D. McCaskey, B. S.

LETTER OF APPROVAL.

Office of the Mining Bureau,
Manila, P. I., August 23, 1902.

The report of H. D. McCaskey, B. S., mining engineer for the mining bureau, of this date, made to the chief of the mining bureau and entitled "Report on a Geological Reconnaissance of the Iron Region of Angat, Bulacan," is approved and recommended for publication.

Charles H. Burritt,
Chief of the Mining Bureau.

Approved:
Dean C. Worcester,
Secretary of Interior.

Office of the Mining Engineer for the Mining Bureau,
Manila, August 23, 1902.

Mr. Charles H. Burritt,
Chief of the Mining Bureau, Manila, P. I.

Sir: In compliance with instructions received from you, and in accordance with the plans of this bureau, to gather, compile, and distribute information concerning the the mineral resources of the Philippines, a field party was organized and placed under my charge during the latter part of February; and the month of March and the first half of April were devoted to an investigation of the iron region of Angat, Bulacan. As the result of the field work, and the subsequent work upon the data, samples, and specimens obtained, in the office, drafting room, and laboratory, I have the honor to submit the following report, together with maps, sketches, photographs, and the tabulated results of analyses.

INTRODUCTION.

It is with grateful appreciation that I here acknowledge the great assistance and constant encouragement given by you through the initial difficulties of this first expedition of its kind under the American régime; and I take great pleasure also in thanking the following gentlemen of the military and civil service for many courtesies that facilitated the work in hand and without which there would inevitably have been annoying and irritating obstacles and delays: Maj. Gen. Lloyd Wheaton, U. S. Army, then commanding the Department of the North Philippines; Col. Arthur L. Wagner, U. S. Army, then adjutant-general of that department; Capt. Ralph Van Deman, Twenty-first Infantry, U. S. Army, in charge of the bureau of military information; First Lieut. Julian De Court, Philippine Scouts, commanding the stations of Angat and Norzagaray; Dr. Paul C. Freer, superintendent of government laboratories; Señor Pablo Tecson, governor of Bulacan; Capt. H. T. Allen, Sixth Cavalry, U. S. Army, chief of the insular constabulary; Mr. W. W. Warren, senior inspector of Bulacan constabulary, and others of the insular government, of the provincial governments of Bulacan, and of the municipal government of Angat.

The party as organized consisted of the undersigned as engineer and geologist in charge, and of the following: William A. Miller, rodman; Luke E. Sessler, cook;

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[a] The illustrations mentioned in this report have been omitted and are on file in the War Department.

Pantaleon M. Geta, assistant rodman; José Fajardo, chief guide; Sebastian Pelez, guide and axman; Manalo Badasto, guide and axman. In addition to the above we were assisted during the earlier part of the work by William Ackerman, an intelligent and capable young man detailed to accompany the expedition by the bureau of military information, and by escort of seven excellent men under Corporal Faustino Soto, from the provincial constabulary of Bulacan, who accompanied the party throughout and faithfully guarded the supplies and government property.

Much credit should be given to William A. Miller, whose active assistance, good judgment, and sturdy common sense in handling the native help were invaluable. The three guides were Tagalogs, natives of the town of Angat, where they were employed. They have been called "axmen" in deference to American usage, and they performed the duties of such in American engineer corps, but they were useless with the ax and were remarkably expert with the bolo; if the term be not too warlike therefor, they were the bolomen of the party. With their long sharp knives they cut the way through what would otherwise be termed the "impenetrable jungle and tropical forest undergrowth." They were gradually taught the duties of flagmen and chainmen, and toward the end of the survey they were doing very satisfactory work.

Their loyalty and their faithful performance of whatever they were given to do were most gratifying. The chief guide really knew less of the trails and of the country than the others, as we found out to our sorrow; but, as there were few trails, and we soon learned those, and as he was more of a leader than the others, and seemed better able to interpret our wants to the other natives whom we employed, or with whom we came in contact, he was satisfactory. As for the native in general, the Tagalogs whom I met and knew in Bulacan certainly gave me a most favorable impression, particularly those of the mountains wherein we worked and camped. The farther we went from the railroad and large towns, the more simple and natural the Filipinos were. I found no difficulty in securing all the labor needed. They were willing and glad to work at a peso a day, from the old, gray-haired men down to boys of 12; and they expected this wage no matter what the class of work nor the length of the working day.

Ample field and camp equipment and commissary supplies were obtained, the former through the insular purchasing agent and the latter from the commissary for the insular civil government. This completeness of preparation for the field was a source of satisfaction to the party throughout the trip and is among those things for which acknowledgment has been made to you. The quality of the food supplied by the insular commissary was uniformly good and in packages suitable for transportation and for use in the Tropics.

Transportation of the party and supplies was by rail from Manila to Bocaue; from this latter station we marched across the plain to Angat and into the hills to the site selected for the camp; and the equipment and supplies were transported by carabao carts to Angat over fairly good roads, and by cargadores over the mountain trails to the camp. Owing to the rate of speed obtainable from the carabaos in the great heat of the sun upon the level plain, the progress was slow, even with the animals hitched tandem to a small cart. Coming back from Angat six weeks later, in a heavy rain, the carabaos made excellent time for their class and traveled on through the day without stop.

The party left Manila on the morning of March 3 at 7 o'clock, reached Bocaue at 8, and in half an hour were loaded up and on the road toward Angat. It was decided to camp upon the Ilag-puti, that being the only good water between Santa Maria and Angat, and the teams not going fast enough to reach the latter town that day. Angat was reached at noon the second day. Here the cargadores were secured through the presidente, and the baggage being redistributed, the march was resumed early on the 5th. A site was selected for the camp upon the Bayabas River, just below the little mountain barrio of La Mesa, and affording a central point from which to operate. This was reached by 11 o'clock of the 5th. Good drinking water was not so readily found in these hills as might be supposed, and the camp site was selected very largely because it was just above the fine large Santa Margarita spring of limestone water and just below some wells dug in the sand from which the filtered water of the Bayabas was obtainable.

In this connection I would state that effort was made throughout the work to observe the common laws of hygiene and health, and with some success; for, although everyone in the party, excepting the guides and myself, had some malarial fever during the six weeks, the small medicine chest furnished by the civil hospital was required for nothing more serious than for quinine for these fevers and for bandages and liniment for the ordinary sprains and bruises incident to active work in rough country.

The camp selected as the base of operations was utilized throughout the entire work, as it was considered less expensive with cargadores at a peso per man per day than to move the entire force from place to place through the limited area proposed for investigation. The working party, however, consisting of the rodman, the guide, and myself, were not thus limited, as we frequently slept out overnight and lived from our haversacks.

Camp was broken on the morning of April 14 and Manila was reached the night of the 16th, the return being made by the route taken in going from here. The guides and the constabulary accompanied us to Bocaue, where the former were paid off and discharged and the latter were sent by train to Malolos.

Immediately upon my arrival account was made to you of all moneys received and disbursed during the expedition. It had been my constant effort to keep all expenses within the strict limit of necessity, and this was found a comparatively simple thing to do. The rates for labor and transportation were pretty well fixed and it required merely the usual vigilance to keep within them. As stated before, the rate demanded of American employers for all classes of work was a peso a day. This was high, and one native iron smelter complained to me that while Americans paid this wage he conld not keep men at work; on the other hand I found that with only temporary employment to offer I could not get satisfactory service for less. The total expense account as submitted and approved shows a lower rate per diem than any American survey of similar purpose with which I am acquainted, and this notwithstanding the higher cost of supplies in general here than in the United States.

FIELD WORK.

In order that the scope might be as broad as possible within the time planned for the field work it was decided to divide the work into the following heads: (1) Reconnaissance, (2) surveying, (3) geological tours, and (4) economic investigations.

These overlapped each other more or less, and each of the latter three would seem to have been quite enough of an undertaking for one man during the six weeks; this being particularly true because no satisfactory maps existed upon which geological plotting might be done, because the trails, undergrowth, and forest were so difficult that progress was extremely slow, and because all of the assistants taken into the field were entirely unskilled and it was necessary to give much time and patience to their training. The ordinary physical difficulties arising from work in the roughest of mountain country with poor trails, or none, through mud, water, and the dense jungle, and in the midst of the hot season, have been overcome by thousands of our gallant soldiers and equally hardy prospectors and other pioneers in the Philippines; and, although they have been commented upon by every geologist who has attempted work in these islands, they are to be taken for granted, and the only excuse for their mention is that to a greater or less degree they unquestionably retard the progress of the work.

Immediately upon establishing Camp Burritt (so named in honor of the chief of the bureau), a series of ascents was begun to the tops of the hills and mountains for the purpose of observing and sketching the country, studying the rock formations in the mass as well as the vegetation and forest growth would permit, and selecting stations for the triangulation work of a survey of the Bayabas River, from the iron region to the confluence with the Angat. Familiarity was thus obtained with the general topography of the country, with the water courses, and with such mountain trails as might be used.

The best map available of this part of Bulacan was found to be one kindly furnished me by Capt. Ralph Van Deman, Twenty-first Infantry, U. S. Army, in charge of the bureau of military information, made from compass surveys, I believe, and to a scale of 1:53,360, or 1 inch equal to 1 mile. This map was found to be good as far as the Angat River, but incomplete in the hill country containing the limestone formations and the ore beds. With this as a basis and with data from the mining bureau and my surveys I have been able to produce a map which, while not itself complete, may be found more satisfactory, I trust, for this interesting eastern portion of Bulacan than what existed before.

The survey work executed was chiefly for the purpose of mapping that part of Bulacan between the Angat River and the iron deposits. For this area I could find nothing of value to suitable scale, and I concluded that time would be well spent in thus covering the ground. The method used was a small tertiary triangulation from peak to peak from the stations of which system points were located for a stadia traverse survey of the Bayabas Valley.

The field notes reduced and plotted enabled me to map the area mentioned. A base line as long as could be measured without the consumption of much time and expense was laid out in the La Mesa Basin, stakes were carefully lined with the transit at distances apart less than 50 feet, and measurements were made with a steel tape from centered tacks driven in the stakes. Levels were then run on the stakes, and the distances, and finally the entire base line, was reduced by computation to the true horizontal. The measurements and levels were all repeated before reduction, and the means were taken for that purpose. The differences were extremely small. Every effort was made to approximate accuracy, because the extremely hilly and difficult nature of the country necessitated so short a line that the greatest possible nicety was required. The device of repeating all angles of the system was also used for the same purpose. Some unavoidable delay and annoyance were caused by the use of native flagmen, particularly when they were at distant stations and could not be intelligently communicated with; but they were ever willing, and they carried out as well as they could what they understood to be their instructions. Their mistakes were natural, after all. After having left their stations once or twice before all of the required angles had been read they showed their good spirit, if not their good judgment, by afterwards remaining standing rigid in the hot sun for an hour or more rather than make the mistake again. Several methods of signaling were devised for communicating with them, but these were only partially successful.

The stadia traverse surveys were as carefully executed, all ordinary precautions for accuracy being taken at all times.

It would be a matter of greatest satisfaction to me to be able to present with this brief report a complete map with contour topography on a scale of 400 feet equal to 1 inch; but with the time and assistance at my disposal and with the pressure of other duties in the field such an undertaking was clearly impossible. The general plan followed throughout the expedition was to accomplish as much as could be done along the various lines decided upon and within the given time and scope. A more detailed topographic survey at this time would have consumed much time, and therefore expense, as the narrow valleys and steep hills were in almost the entire area thickly covered with dense tropic undergrowth or heavily wooded. Lines of sight would have necessitated continued cutting, and every foot of progress would have been slow and laborious. But little land has been cleared, and the forest is for the most part virgin. It would seem judicious therefore to anticipate detailed work of the highest accuracy by exploratory surveys until better maps are had upon which to outline more expensive work.

Unless the field geologist be supplied with abundant time and facilities for first making a topographic map and from that a geological map, he should go to his labors with the results of topographic work in his hands. It did not seem possible or wise to me for the reasons given in the preceding paragraph to attempt the location of all geological horizons and the plotting of the various geological areas. This work will follow, I trust, in due course of time when sufficient trustworthy data will have been gathered to make such a map reliable. The materials are not yet at hand for this culminating stage of field geology, and an attempt to attain at this time the object desired would result in an imperfect map, which might be suggestive, but which would probably be misleading at best. Mr. Richard von Drasche has with commendable energy and purpose begun such a map of a portion of Luzon; but that his data was not sufficiently complete to warrant the plotting of such extensive areas as he attempted has been shown by the later work of Señor Abella, possibly the most distinguished geologist of all the former inspectors of mines. That one, at least, of Mr. von Drasche's conclusions upon incomplete data was correct, however, I shall attempt to show in a later portion of this report.

My geological tours were along the ravines and water courses, across the ridges and hilltops, and over part of the rolling country between the hills and the Angat River. I visited springs and caves and brought back to the office a suite of about a hundred and fifty specimens, some of which have been analyzed and not all of which have I had time as yet to thoroughly work over. For lack of time and of complete facilities for this class of work, the rocks to be analyzed, as of more immediate economic importance than the others, were referred to the bureau of government laboratories, and to the chemists of that branch of the service I am indebted for the analyses herein given.

A diligent search was made for fossils during the progress of the field work, but with the exception of three or four very imperfect ones from the Baras-bacal limestones none were found.

The economic investigations were confined to a careful study of the native method of iron smelting and of lime burning in addition to the securing of such information as I could obtain concerning the mineral resources of this part of Bulacan. I must express my indebtedness to Señor Mariano Suarez, treasurer of the town of Angat, who operated the only furnace in blast in this region during the time of my visit, whose plant I inspected several times, and to whom I owe acknowledgment for many details always courteously given. Further interesting information was obtained from Doña Maria Alteza Fernando, whose new camarin was being built during the time of my visit and whose maestro, or smelter boss, told me much from his long experience in his special work. I gladly acknowledge the uniform courtesy and attention shown by all these smelter people engaged in this most interesting and useful industry.

PHYSICAL AND GEOGRAPHICAL.

The province of Bulacan lies within the central part of Luzon, its boundaries touching those of Nueva Ecija on the north and northeast, Infanta on the east, Rizal on the south, Manila Bay on the south and southwest, and Pampanga on the west. The eastern boundary is part of the crest of the great cordillera of Luzon, and part of the western boundary is the extensive Candaba swamp, which marks a pronounced depression in the low plain between the cordillera and the Zambales range. In general, therefore, this province lies tilted toward the east and the rainfall caught in the mountains and foothills makes its way west. That part of the main range constituting the extreme eastern boundary, the long spur running from the northeastern corner of the province almost to San Miguel de Mayumo, and the series of hills and foothills parallel to the range and extending west as far as Angat and San José del Monte, constitute the hilly portion of Bulacan, and this in area is a little over half the province. This is the undeveloped part, and it contains but a small portion of the population; and herein lie the mineral deposits and springs, the valuable forests, and the beautiful little mountain valleys and basins that must sooner or later prove very attractive to American farmers here.

The Rio Grande de Pampanga flows across the southwestern corner of the province, emptying into Manila Bay by many mouths. The Angat is the most important river in Bulacan, and with its many tributaries it drains the greater portion of the province. Rising in the extreme northeast between the Pahalang Mountains and the main range it flows south, receiving the waters of the Malabid and the Ipo from the east, then turns west flowing past Norzagaray and northwest receiving the Bayabas just below Angat; from here it flows west past Maronco and San Rafael, turns south between Bustos and Baliuag to Quinga, from which place it flows west, emptying into the Rio Grande de Pampanga near Calumpit.

The Meycauayan, Marilao, Ilag-puto, Bocaue, Guiquinto, and Divisoria are short streams flowing south and southwest and emptying into the bay by many mouths south of the Angat, and the Maasin (Upig), Garlang, Balaong, San Miguel, and Buto form a series of mountain streams rising in the foothills north of the Angat and flowing west emptying eventually into the Rio Grande de Pampanga.

Almost the entire area between the roadway of the Manila and Dagupan Railroad and the bay is low, swampy land intersected by the numerous esteros of the delta of the Rio Grande. These form, from their very number, the most convenient means of getting from place to place in this part of the province.

There are many mountain limestone springs of cool, refreshing water, such as the Santa Margarita spring, on the south bank of the Bayabas, just below La Mesa, where the river cuts through the limestone formation, and where through the joints and fissures the waters gush out from the rock cool and sweet and clear. In addition to these, however, there are two well-known groups of mineral springs, both of which are called Sibul, which is the Tagalog word for spring. Notes upon the history, chemical and medicinal properties of these springs are given here without apology; they are abstracted partly from records in the mining bureau, partly from my own notes, and given largely for the benefit of invalids and physicians who may not find the information otherwise available; and in a later part of this report, notice will be taken of such geological information as exists upon the subject.

NOTES ON MINERAL SPRINGS.

In the early part of 1891 the principales of San Miguel de Mayumo petitioned the governor-general to allow them to construct a reservoir for the utilization of the surplus waters of the mineral medicinal springs at Sibul. This was granted May 13 of that year, upon the condition that the people of that vicinity should be given gratuitous use of the waters of the reservoir.

The inspector of mines was instructed on June 16 to locate a site for this reservoir so that the rights of the government in all springs of this class should not be prejudiced.

Señor Abella, the inspector of mines at that time, went to Sibul and found that the natives had anticipated his arrival by enlarging the openings of two adjoining mineral springs to such an extent that they would have received very much more than the surplus waters for the reservoir. Their excavations had also seriously impaired the respective virtues of the two springs, "San José" and "San Miguel," by mixing the waters; and all this in direct violation of the regulations of the royal decree of February 27, 1890, which stipulate that "the establishments of mineral waters of Cuba, Puerto Rico, and the Philippines, designated for the cure of whatever infirmity, shall be under the jurisdiction of the ultramarine minister, to be directed in conformity with these regulations." (Chap. I, art. 1.) Also that "no new establishments of medical mineral waters may be dedicated to the public service for therapeutical purposes until the ultramarine minister has first declared the public utility of the waters and conceded the corresponding authorization for its opening." (Chap. II, art. 5), and also that "if he (the governor) should decide favorably upon the construction of the establishment he shall order to be made the plan prescribed by paragraph 2, article 8 and, with the advice of the mining engineer, and a medical director by fixed appointment (if there be such) he shall indicate the perimeter of expropriation to be extended, of the territory adjacent to the spring, for the erection of the establishment and all of its dependencies." (Chap. II, art. 13, Par. I.)

Upon noticing these infractions of the law and the endangering of the usefulness of the spring, Señor Abella at once reported the facts to the governor of Bulacan and to the governor-general of the islands, making suggestions to the latter which were approved and ordered carried out. These suggestions embraced the establishment of two circular zones with the baths as a center, within the first of which no excavation or construction of any kind might be permitted, and within the second of which there be allowed no excavation to a greater depth than 2 meters. These suggestions seem worthy, being based upon a geological study of the formations there found; and they were intended to work for the conservation of the greater public benefit from the baths.

Not until November of 1891 could the inspector proceed with the demarcation of the zones, owing to the heavy rains. He then performed the work and submitted a report with plans, copies of which are herewith given, showing the location of these interesting and valuable medicinal springs.

Abella, in his report, assumes that these springs are caused by the uplifting, folding, and breaking of the strata by the extrusion from below of modern augite andesites. From the fact that the overlying strata are alternate layers of sandstones and shales, more or less porous, based upon limestones, because of the low thermality of the waters, and because of their fluctuations in volume according to the season, he also infers, and probably correctly, that waters of infiltration meet the subterranean waters released by the fracturing above mentioned, and that the final flow from the mouths of the springs is that of mixed subterranean and surface water.

The second visit of the inspector to these springs, which led to a more detailed study of them and to a chemical analysis and to the gathering of physical data, was brought about in rather a curious way.

In 1893 the medical director at the baths wrote to the "department of beneficence and sanity" requesting to be relieved of his responsibility and stated the following reasons: "The increasing difficulties he encounters in the execution of his duties, not only because of the continuing reasons and protests of the public who resist the payment of dues, but more especially for the nonexistence of an establishment, and lack of installation of apparatus for the technical employment of the waters; neither is there an office for the medical director nor anything else to harmonize with the official decorum and the delicate mission," etc. He further states "that as an extraordinary credit has been conceded for the purpose of commencing the work on such an establishment" he would be glad to give his services, upon the same salary as he then drew, to the commission then at work upon the mineral springs of the archipelago.

The indorsement upon this petition, written by the chief of "beneficence and sanity," probably gave the medical director food for thought and reminded him that even admitting that the bathing establishment was not then in the condition in which it should be by law for the use of the public, notwithstanding the explicit instruction of the royal decree above quoted, and admitting that the director was not provided with a suitable office and might thereby have been subjected to more or less official indignity, still there was work to do.

He was informed that the ground should be cleared and prepared for the new buildings projected, and that particularly all vegetable decaying matter and other matter subject to putrefaction should be removed as it had been repeatedly reported in Manila that invalids at the springs had frequently contracted fever during their stay at Sibul; he was also informed that, as a number of physicians had complained that the waters of the baths no longer gave the marvelous curative results for which they had become famous, a minute physico-chemical study should be prosecuted to determine the causes of such changes, if any, and he was further advised "to collect topographical, medical, geological, and meteorological data and notes respecting the flora and fauna of the locality," all of which were to be embodied in a report which should be the basis for further proceedings.

The recommendations sent with this indorsement were two, and the second is of interest because it brought about two more very careful studies of the waters, the results of which are here included. These recommendations as confirmed by the director-general of civil administration, and as carried out, were: "First, that the resolutions relative to the medical director of the Sibul baths be suspended until it can be determined to a certainty if these springs have suffered a qualitative alteration that may have modified their therapeutical action; in which case, it would be necessary to suspend the execution of the works. Second, to send this expediente to the general inspector of mines in order that as quickly as possible the waters may again be analyzed. * * *"

In November of 1893 the inspector of mines, Señor Enrique Abella, went to Sibul, with apparatus and assistants, and he verified his former geological reconnoissance and obtained data for a complete report upon the waters of the springs. He found few and slight changes in the waters indicated by the differences between his results and those of the Centeno commission of 1885; and these variations he ascribed, not to the springs themselves, but partly to the different details of methods used in the analyses and partly to the varying proportions of surface to subterranean waters, according to the seasons of the year. The waters had not deteriorated.

The results obtained by the second commission were published in the Official Gazette of January 28, 1894, but, as Abella says, "They were mistakenly interpreted by the inspection of beneficence and sanity * * * and therefore has made it necessary, as the governor-general considered, to make a new study of the spring."

So all of this expensive and laborious work was repeated in February, 1896, and as Abella and his colleague had executed the analyses before, and each had checked the work of the other, Abella, who was still president of the commission, detailed the new member, Don Antonio Luna y Noveccio, professor of the municipal laboratory, to take exclusive charge of the chemical analyses of the waters. The results thus obtained agree almost exactly with those of Abella in 1893, and very closely with those of Rosario in 1885. The mean of the three analyses is here given as representing the average conditions of flow and of mineral constituents.

These analyses were all performed upon the waters of the San Rafael spring of Sibul. The San Matilde waters show similar results, and from the position of this spring with relation to the folding and fracturing of the strata, it is considered merely another outlet of the same body of underground waters as furnishes the waters of the San Rafael. The San Jose spring, which is ferruginous, and which flows only in the wet season, is not considered with the two springs above mentioned, because it is undoubtedly merely supplied by surface waters filtered through the strata and taking up minute quantities of iron in their descent.

The final report upon the San Rafael spring shows:

First, that the temperature of the waters (28° C.=82.4° F.) has remained constant throughout the twenty-four hours of the day and during all the seasons of the eleven years up to 1896.

Second, that although the spring is of subterranean origin, its flow is augmented by quantities of surface waters varying according to the season. Thus, in April, when the season is dry and the conditions normal, the flow is 57 liters per second; in February, when the effect of the rains is still felt in the mountains, the flow is 77 liters per second; and in November, when the storms prevail, the flow increases to 85 liters per second.

Third, that the quantity of sulphureted hydrogen varies from year to year, apparently in cycles, as is common in other springs where the sulphydric acid is a notable constituent, but that this variation does not affect the value of the spring.

THE SIBUL OF SAN MIGUEL.

There were three springs in 1885 at the barrio of Tartaro, or Sibul, about 10 kilometers from San Miguel de Mayumo, of which one, the San Jose, was ferruginous, was supplied by surface waters, and therefore inconstant in flow, and has since lost its identity by having been merged with the waters of the San Rafael. The second spring, the San Matilde, is but another outlet of the waters which furnish the flow from the San Rafael.

Connected with this latter valuable and well-known spring, the Spanish Government had established baths and placed them in charge of a medical director. Patients were sent to the San Rafael baths from Manila, and the waters were famous for their curative properties.

SAN RAFAEL SPRING.

In a small ravine, to the northeast of the church of Sibul, is found the San Rafael spring, the waters of which collect in a small pool about 5½ meters in diameter. In the bottom of the pool there is a deposit of calcareous tufa as a product of sedimentation. The water gushes out profusely from a small crevice in the rock upon which this deposit occurs. There is an orifice in the east wall of the pool, a few centimeters above the surface of the San Rafael waters, which furnishes an outlet for the San Jose spring, and the waters of the two springs are thus mixed and flow from the San Rafael together.

The temperature has always shown the same reading and is 28° C.=82.4° F. The water is clear and transparent in small quantities, and is of a light bluish tint when observed in large volumes. The odor is strongly that of sulphureted hydrogen, and the taste is that characteristic of the same gas. Litmus paper is unacted upon by the water, but paper soaked in freshly prepared lead acetate is blackened both by immersion and by suspension.

The water is spontaneously gaseous and bubbles of liberated gas rise to the surface both when the water issues from the spring and when it is contained in a bottle or in a glass.

The average flow is 73 liters per second, the constant temperature 28° C., and the mean density 0.998443.

The therapeutic uses of the San Rafael waters are recommended for *dermatosis humedas*, ulcers, herpes, chronic gastro-intestinal catarrhs, dyspepsia, chronic dysentery, hepatic tumors, and menstrual disorders. The waters should not be used by those having affections of the heart or the gout.

The waters should be used in the bath, and doses of from two to four glasses daily may be taken internally.

The San Raefal season is from November to May, when the waters are normal and when the climatic conditions are most salubrious and conducive to the rapid convalescence of the invalids.

SAN MATILDE SPRING.

About a kilometer to the north of the preceding, and flowing into a pool excavated in the plain, the San Matilde spring is found. Upon leaving their basins the waters of both the San Rafael and the San Matilde springs flow into the Rio Chico. There is an abundant escape of gases, as shown by the bubbles rising to the surface.

The water is clear and transparent in small quantities and is slightly opaline and of a bluish tint when viewed in the mass. It is sulphydric in odor and taste, of an acid reaction so slight as to be almost imperceptible, and is of minute variation in temperature.

When used in the bath it produces a general excitation more or less intense and increases the activity of the reflex power of the nervous system. Taken internally it occasions a stimulation in the gastro-intestinal apparatus, related in intensity with the state of irritability of the organs. In small doses it augments the contractive force of the muscular tunic of the stomach, stimulating the circulation and materially modifying the digestive functions, facilitating the complete absorption of substances that can be assimilated.

The oxidation and temperature are therefore augmented, the circulation is more active, and the breathing more ample.

In doses of 200 grams, repeated several times during the day, the excitation of the stomach is more intense, and a great part of the water passes to the intestines, where it produces an exosmotic current, awakens the contraction of the muscular tunic, and originates evacuations of a dark color in which dominate the coloring elements of the bile, the mucus and the cellular detritus.

If the doses exceed 500 grams, as they do in the case of almost every invalid at Sibul to whom they are administered, the dialytic action is mechanical, and the evacuations are preceded by a sensation of very oppressive burden and great pain.

These waters of the San Matilde spring are recommended for cases of *dermatosis humedas*, chronic catarrh of the digestive tube, dyspepsia not related with alterations of the texture of the organ nor with a general morbid state, tumors of the liver and of the spleen, neuralgia provoked by hysteria, leucorrhœa, menstrual hemorrhage, and chronic parenchymous inflations of the matrix sustained by the herpetic constitution, or by anæmia.

The waters are useful in cases of chronic dysentery when the disease has not progressed too far and the alterations of the mucous intestinal texture are not considerable; and they are particularly useful, like those of the San Rafael spring, in dysentery originated by circulatory overthrow of the vena portæ and when this infirmity is shown in persons subject to the influence of herpes.

The waters should be used in baths of short duration and in carefully graduated internal doses not exceeding 400 grams; and the season for treatment is from November to March.

THE SAN JOSE SPRING.

This spring, as before stated, is of small volume and its waters flow into those of the San Rafael. The supply being from the surface, the flow is more or less uncertain.

The water is colorless, with a slight sediment, without odor, and of slight preceptible taste of ink. It is without the evolution of spontaneous gases and is of neutral reaction.

The use of these waters is recommended for chlorosis, anæmia, dyspepsia, gastralgia, and for other disorders of the digestive tube, for leucorrhœa, and for all states of convalescence characterized by general debility.

The waters are not advised for gastro-intestinal disorders with organic lesion.

The dose recommended is from one to three small cups a day, and the season is from November to May.

THE SIBUL OF NORZAGARAY.

Upon crossing the Angat or Quingua River at Norzagaray, passing through the barrio of Matictic and traversing a fairly good road, over foothills and valleys for about 2½ miles to the northeast, one arrives at the banks of the Mabato Arroyo. Here the road ends abruptly, and its continuation is a narrow footpath, that follows up the stream bed for a short distance and then makes northeast over the hills to the little mountain village of Balite. The Mabato rises to the southeast of the Bocol limestone hills, flows past the southern hill of this range, and turning southwest empties into the Angat River at Norzagaray.

On the south side of the creek about 300 feet below the road there is a little cup-shaped basin 3 feet in diameter and 3 feet deep, at the base of the hill, in which I found in April some mineral water almost stagnant from the small volume of supply, bluish in color when clear, with a heavy black muddy sediment, and with strong odor of sulphureted hydrogen. This was called by the Spanish the Dilain spring. About 350 feet above this spring, just beyond the terminus of the road and on the north side of the Mabato, a small stream of clear water comes through a fissure in the limestone of which the Bocol hills are constituted, discharges into a basin cut in the rock, the outlet of which is a channel a few feet long. Through this channel the waters discharge into the Mabato only a foot or two below the level of the spring. This is the spring called by the commission on mineral springs, of 1885, the San Mariano spring, in an attempt to avoid the confusion from the use of the Tagalog word "Sibul," which means "spring" and which the natives use for both these waters, near Norzagaray, and for those near San Miguel de Mayumo.

When I visited this place in April, 1902, I found no buildings of any kind, although I was told that an American prospector had located and staked out this spring, constructed a small nipa house in the vicinity and was living there. I found the remnants of a bathing tank of rough masonry at the Dilain spring and parts of a tile pipe line, and some slight masonry arching to strengthen the opening, at the San Mariano. The natives said that ten years before my visit, or in 1892, the sitio of Sibul consisted of 18 or 20 houses. The people of Angat, who sent to these springs for the waters, were willing to pay a medio peso for a quart bottle, as great faith has been entertained for years in the curative powers of the waters. I was also informed that the Spanish Government some years ago had planned rather an extensive sanitarium here, but that for some reason or another it had not been constructed.

My brief observations would suggest that this or any other available part of the hill country of Bulacan would be suitable for more rapid convalescence than might be possible in Manila or in the lowlying plains and fields adjacent to the bay.

During the midst of the hot season I found the air refreshing and comparatively cool in the shade, the water of the mountain streams clear and sweet and uncontaminated, apparently salubrious and healthful. At night we were quite comfortable under blankets; every morning cool, bracing mountain breezes blew, and out of the direct rays of the sun the air was refreshing even through the middle of the day. We were not annoyed at any time during our six weeks in the hill country by mosquitoes. It would seem that should the waters of either the Sibul of Norzagaray or those of San Miguel be considered as valuable by the American physicians and government as they were held by our Spanish predecessors, sanitariums might be established at or near these places with great profit to the convalescents. The baths of Bulacan are quite readily accessible, the one near Norzagaray being particularly so. A fair carriage road exists between the railroad station of Bocaue and the town of Norzagaray, and the remains of a road that should be readily repaired lead to the Sibul. The river can be forded during the dry season, and the entire distance from Manila to the Sibul can be made in from five to six hours.

During my visit in April, the hottest part of the year, the Mabato Creek was running and the San Mariano spring flowing. The Dilain spring, on the other hand, was almost without flow, the outlet from the basin just trickling over the sands to the creek.

THE DILAIN SPRING.

The waters of the Dilain spring are clear, transparent, and colorless in small quantities and bluish when viewed in the mass. There is a heavy, black sediment, partly in suspension, which, with the strong odor of sulphureted hydrogen, and the bitter, salty, sulphydric taste, render the spring most unattractive.

The water is slightly acid and effervescent. It is useful, both in the bath and internally, for herpetic affections, scrofula in all its manifestations, infirmities of the urinary passages, articular tumors, and catarrhal affections of the matrix.

THE SAN MARIANO SPRING.

This spring flows through a crevice in the semicrystalline limestone rock on the north side of the Mabato, within 6 feet of the edge of the water in the dry season, and the waters collect in a small basin in the rock not more than a foot above the level of the creek. It will readily be seen, therefore, that when the annual rains begin, and the waters of the mountain stream rise, the spring will flow into the creek below surface level, and its identity will be lost. Through two other small fissures of the limestone strata, at the contact with the water, very small streams flow into the Mabato. In each of the cases the water coming through the rock, upon mixing with the waters of the creek, leaves a fine white precipitate. This calcareous precipitate is also found in less degree in the small basin from which the waters of San Mariano find their outlet.

A careful test with a standard thermometer of the temperature of the San Mariano spring gave me, on April 1, 1902, a reading of 77° F., which corresponds to 25° C. The Spanish commission in February of 1885 found a temperature of 26.5° C. with the atmosphere at 26° C.

The San Mariano waters are clear, transparent, and colorless in small quantities, and bluish in the mass. The odor and taste are those of sulphureted hydrogen, the reaction is neutral, and the water is noneffervescent.

The waters are recommended in the bath and to be taken internally for cases of chronic gastro-intestinal catarrh, dyspepsia, tumors of the liver, in menstrual disorders, in herpetic manifestations, and in dermatosis.

The season for the use of the San Mariano and the Dilain springs is from November to May.

FLORA AND FAUNA.

A careful study of the flora and fauna of these islands is of great importance in the solution of our geological problems here; and it is hoped that eventually there will be some department of the insular government corresponding to the Smithsonian Institution at Washington. No exhaustive research has as yet been made by me to ascertain to what extent work has been done in these fields in Bulacan. During our short tour, however, I interested William A. Miller in getting what information he could concerning the most important forest trees found in the hills in the neighborhood of the iron deposits. We found the natives rather intelligent upon these subjects and surprisingly interested in our many questions about them. These wild people are nature's children and many of them know their woods and streams fairly well.

Much credit is due Mr. Miller. It is my opinion that if he were to dedicate himself to the work of a collector he would find employment for which he is particularly fitted. We could give but odd moments during our tramps to the gathering of information of this kind, and we did nothing in botany proper

The hills of Bulacan are rich in varieties and numbers of birds, some of which are songsters. We recognized the Calao bird of the Tagalogs (*Buceros hydrocorax*), a large hornbill with bright plumage and a remarkably red bill and head several inches long, a fruit eater and highly prized by the natives for its flesh; the jungle bird (*Gallus gallus*), and the Poloma de puñalada of the Spaniards (*Columba cruentata*), a beautiful dove with a white breast, in the midst of which is a blood-red spot as if from a dagger thrust. There are many birds that fill the air with their songs and cries, and among them kingfishers of gorgeous colors, some birds that I thought to be orioles, and along the water courses herons, snipe, and plover.

Among the animals was the Philippine monkey (*Macacas philippinensis*) called "maching" by the natives; wild boar and deer, and wildcats; and there is a very interesting fruit bat of great size, one that I killed measuring 49 inches between tips of extended wings. A large colony of these fruit bats lived in the trees on the west side of the Baras-bacal Hills, hanging in such numbers that the trees seemed completely draped in mourning. These bats mounted in the air at sunset and flew over our camp to their feeding grounds. They seemed arranged in one long column to the number of 6,000 to 10,000 by our estimates. The natives frequently asked us to kill them, as the flesh is highly prized. These bats have the head of a fox and are of great size, even the young ones just able to fly being larger than our house bats.

An interesting group of insects is found in the woods and fields among which are the large red ants whose bite is very painful, and who make themselves nests of the size and shape of a football by bending together the living leaves of the tree and cementing them at the edges; and a spider that I found in the inner recesses of the Puning Cave, whose legs numbered seven; those nearest the head measuring 5½ inches.

Among the trees observed by Mr. Miller in the fields and hills of eastern Bulacan, of which brief notes were made, with sketches of the leaf and flower, are the following:

Tagalog name.	Scientific name.	Group.	Where observed.
Acle	Pithecolobium acle	1	Near Bayabas barrio.
Alibambang	Bauhinia malabarica		Foothills and mountains.
Anilao	Columbia anilao	4	Sampaloc barrio.
Aninapla	Albizzia procera	3	Bayabas River.
Antipolo	Artocarpus incisa		Bocol Mountains.
Balete	Ficus		Bayabas River.
Bayabas	Psidium guyava	3	Mabato Creek.
Bayoc	Pterospermum blumeanum	3	Sampaloc barrio.
Binayuyo	Antidesma cumingii	4	Bocol Mountains.
Calumpang	Sterculia fœtida	4	Do.
Catmon 2d	Dillenia philippinensis	2	Bayabas River.
Cupang	Parkia roxburghii	3	Mount Calabaza.
Himbalao 2d	Excoecaria	4	Mount Sampoloc.
Lanete	Wrightia ovata	1	Mabato Creek.
Lauan	Anisoptera thurifera	3	Foothills and mountains.
Lujong	Diospyros		La Mesa barrio.
Mayapis	Dipterocarpus turbinatus	3	Bayabas River.
Narra	Pterocarpus indicus	Superior.	Foothills and mountains.
Panao-balao	Dipterocarpus vernicifluus	3	Mount Calabaza.
Pandacaqui	Tabernæmontana	4	Mabato Creek.
Pandan	Pandanus?		Bayabas River.
Sampaloc	Tamarindus indica	3	Do.
Tanguile	Dipterocarpus polyspermus	2	Mountains.
Tampoy	Eugenia jambos		Pangisijan Creek.

Our notebook containing sketches and field notes concerning the above trees was referred to the forestry bureau for such use as might be made of it. I am indebted to that bureau for supplying the scientific names given above.

In general the hills and mountains of eastern Bulacan are heavily wooded. Clearings have been made in the immediate vicinity of the little barrios and in the foothills, but the higher mountains are rich with closely crowded standing timber, as may be observed in photographs accompanying this report.

GENERAL.

Bulacan is a small province, but a very rich one; and the well irrigated, lowlying lands yield annually large quantities of rice; sugar cane, corn, and indigo are also cultivated. The fine, ripe yellow corn was being brought into Angat during the first weeks of March, and much of it that I saw was apparently of excellent grade. The soil is rich and fertile and would seem a most profitable field for experiments with modern farming methods. Much of the best of the lowlands at present is owned by the friars, but with the success of the negotiations now being made for their release it is to be hoped that many broad acres will soon be freed for a really valuable test of what can be done with the productive lands of the Philippines.

Bulacan is under a most successful civil government, ably conducted by Señor Pablo Tecson and his associates. Governor Tecson was the best leader in the province during the insurrection, and he won the highest reputation for honor and military ability. He eventually became convinced of the futility and the mistake of resistance, and he surrendered a large and well-equipped and disciplined body of troops. He is greatly loved by his people, and I was told by several of them that his attitude has had much to do with the present peaceful and gratifying condition in Bulacan.

The capital of the province is at Malolos, and the largest towns, with their approximate populations, are as follows:

Angat	8,000	Malolos	15,000
Baliaug	14,000	Norzagaray	5,000
Bocaue	10,000	Paombong	10,000
Bulacan	13,000	Pulilan	10,000
Calumpit	15,000	San Miguel de Mayumo	20,000
Hagonoy	20,000	Santa Maria de Pandi	10,000

The total population before the insurrection was about 240,000, and the total area is estimated at about 226,806 hectares, or about 560,438 acres.

The industries followed are extensive cultivation of the soil, fishing (not only in the bay and in the rivers and their outlets, but also in every stream, including those of the mountains), the manufacture of hats, piña and jusi cloth, and to a very limited extent the cutting of timber and the mining and smelting of ore. The people are apparently fairly given to their respective labors, and, in general, good order and industry reign throughout. Prosperity has not yet returned to the province, and a large proportion of the people are miserably poor. It is hoped, however, that with the natural resources, with continued and increased industry, with the possible influx of better and more economical methods, and with the present excellent government, good order, and peaceful conditions, this province, so favored by nature and man, may soon find itself blessed not only with peace but also with prosperity.

GEOLOGICAL.

The delimitation of the geological boundary lines in the province of Bulacan has not yet been accomplished, for the reasons that, up to the present time, very little purely geological work has been done in this province; and the greater part of the fragmentary evidence at hand relating to this area has been obtained in connection with objects other than the particular study of Bulacan.

The very small amount of material bearing on this subject and available for review has been translated by me from various pamphlets, monographs, and records in Spanish forming part of the archives of this bureau. These included papers and reports by Centeno and Abella, who were eminent engineers and geologists of the Inspección General de Minas, and extracts from the writings of the foreign travelers and explorers, Itier, Semper, and Dr. Richard von Drasche.

In his interesting monograph upon the Taal Volcano, published in Madrid in 1885, Señor José Centeno, inspector-general of mines for the Philippines, has the following to say under the section "Prehistoric Eruptions:"

"The narrow limits within which is comprehended the history of this country, not exceeding three hundred and fifty years, do not permit an account being given of the great vicissitudes and metamorphoses which this region has undoubtedly suffered, if we take into consideration the special circumstances which concur in it. First, on account of its situation submerged in the midst of a deep lake so near the sea and only separated from it by a narrow border of land composed exclusively of volcanic products; secondly, because of the great area covered by these products, which appears to begin from this volcano as a center and to extend south to the sea and north as far as the town of San Ildefonso in northeastern Bulacan, distant 115 meters (71.5 miles), constituting a small isthmus which separates the Bay of Manila from Laguna de Bay; so that the volcanic tuffs thus constitute without interruption the soil of a great part of the area occupied by Bulacan, Cavite, Laguna, and Batangas provinces. This great area, covered with volcanic products probably thrown out from Taal, reveals a prodigious activity in remote epochs, historically speaking, since no tradition concerning it was known by the inhabitants when they were first conquered; but in modern times, geologically considered, since these tuffs lie above the latest Tertiary formations appearing in various points in northeastern Bulacan and made up for the most part of coralliferous limestones which serve as the separation of the two formations—the volcanic of the plains and the crystalline of the cordillera.

"These immense deposits of volcanic tuff * * * attain considerable thickness in some places, forming superimposed beds of analogous elements, but of distinct structure, which indicate by their relative thickness and by the disposition and form of their components the importance and the nature of the successive eruptions of ashes, pumice, and volcanic detritus which in general constitute them. We have seen the tuff amount to a depth of 31 meters (102 feet) in some of the excavations recently made for the waterworks of Manila, the various beds being separated by other thinner layers of fine-grained sandstones, which were undoubtedly formed by aqueous sedimentation during the intervals of repose of the volcano. The considerable extent of said tufaceous formation, as also the notable thickness found in some places, make one suspect, with reason, the more or less remote existence of a great volcanic focus, of which perhaps the islet, partly submerged, which to-day constitutes Taal, would be some slight remains. This hypothesis has been already proposed by Padre Martinez de Zuñiga, who explained the existence of the deep lake of Bombon by the submersion of a great volcanic mountain; and F. von Hochstetter, according to von Drasche, adheres to the opinion of Pardre Zuñiga, putting it more concretely in the following paragraph:

"'This crater, although it is elevated now, is not higher than the base which remains of a volcanic cone long since submerged, which must have had an altitude of from 8,000 to 9,000 feet and must have been the highest in Luzon, the Lake of Bombon and the present cone of eruption having been formed after the sinking of the first.'

"The Padre Buceta adopts, also, in his Geographic Dictionary, the hypothesis of Padre Zuñiga, giving it, we know not with what authority, a certain character of being historic in the following paragraph, which, with the idea of describing the different eruptions of Mayon in Albay and of establishing comparisons with Taal, asks:

"'Would it be wondered at if the vicinity of this volcano (Mayon) should come to be reduced to a lake, as happened with the other in the province of Batangas, the mountain being submerged without leaving above the waters more than a volcanic island?'

"Finally, the illustrious geologist, von Drasche, whose excellent treatise upon Luzon we have frequently cited, without daring to adopt absolutely this hypothesis, expresses himself, nevertheless, as follows:

"'I have never succeeded in finding out if so great an event (the sinking of the old volcano) has taken place in an epoch in which the Philippines were inhabited; but I have as security that the porous tuffs which are found in all parts (in the region of central Luzon) correspond to eruptions of this old volcano, it being possible that some day there will be discovered data among them, partly by paleontological, partly historical, which will solve the question.'

"After such authoritative opinions, with those which essentially confirm the hypothesis, we can add but little upon this point. We shall present some additional observations, nevertheless, which, being pertinent, tend to support the hypothesis.

"The situation of the Laguna de Bombon, separated from the Bay of Balayan by a narrow stretch of volcanic tuff of slight elevation above the level of the sea and of modern formation, indicates, therefore, that before the last eruptions of the volcano formed this dike the waters of the said bay penetrated as far as the site occupied to-day by the lake; and that here lies the rational and logical explanation of the marine fishes (note 1) left in it and of the plants of the seashore. * * * Therefore, if account is taken of the small present focus, with the insignificant altitude and the historical eruptions of which we know, and if we can not find a sufficient explanation of the existence of such extensive and deep volcanic formations as we have cited, it is natural to suppose, as Hochstetter did, that another volcanic cone existed of greater dimensions, because its eruptions and showers of ashes and cinders reaching greater altitudes could have been impelled by the winds and have fallen over a greater extent in the neighborhood of the focus. It is not possible to fix now, in a definite manner, the altitude of this cone, nor to assert that it was the highest in Luzon; but its situation can be fixed, perhaps, if the form and contour of the mountains now about the volcano be taken into account. It is an observed fact that Mount Macolod, 966 meters (3,168 feet) high, slopes toward the lake so rapidly that it appears to indicate great separation, disengagement, and slipping of the rocks which constitute it; and further, that the opposite slopes, toward the great mesa of volcanic tuff, at 300 meters (984 feet) above sea level, are less abrupt, and it is only near the summit that indications of slipping are seen. All the great mesa which extends from one side or the other of Mount Macolod terminates similarly at the lake in an abrupt manner, presenting steep and almost inaccessible slopes, indicating here also the probability of slipping or abrupt submergence like those of the western slopes of Macolod.

"If we observe the opposite part of the lake we shall see that the cordillera called 'Tagay-tay,' which is limited to the north and terminated toward the east by Mount Sungay, has also its southern slopes of rapid fall, and at some places in the border of the lake appear great escarpments of 20 meters (66 feet) and more of altitude, that are almost vertical, as at Mahabangato, in Banga, and at Balitbiring, in Caloocan, in which the horizontal strata are very clearly seen, indicating also that said escarpements have been formed by the sinking of a part of this formation whose surface of slipping or fracture is the same escarpment; further, that on the northern slopes, which form the territory of the province of Cavite, the ground falls smoothly and without noticeable break from 500 or 600 meters (1,640 or 1,968 feet) of altitude, which the cordillera attains, to the level of the Bay at Manila. If we imagine a section passing through Mount Macolod and the present crater, reaching to Manila Bay, crossing the Tagay-tay Cordillera, we shall see graphically represented the above observations; and, following this hypothesis, if we prolong the lines which can be considered as remnants of the slope, we may hazard a restoration of the ancient volcano. * * * There would result in this manner a volcano of great dimensions, whose circumference at the base would measure not less than from 90 to 100 kilometers (56 to 62 miles, somewhat less than that of Etna), and whose altitude, on the supposition that there were no great irregularities in the inclinations of the slopes, could be placed at some 3,750 meters (12,300 feet). It is not pretended, even remotely, that such figures would be even approximate, but it can not be doubted that the supposed volcano must have had very great dimensions if we take into consideration the great extent and notable thickness of the formations of tuff which have been ejected from its interior.

"If we suppose an average thickness of 15 meters (49 feet) for this formation of surface without counting the part at the present time submerged in Manila Bay and the Mindoro Sea, is approximately 2,800 square kilometers (1,081 square miles), there would result a volume of material ejected by this volcano of 42 cubic kilometers (10 cubic miles), besides that corresponding to the unknown marine part, and the great quantity of ashes and cinders, in an extreme state of division, which could have been carried by the wind to great distances without giving place to true beds of sediment. All of these added volumes would produce consequent voids in the interior under this great cone, and the natural depression or submergence of a great part of it in one or many epochs, more or less apart.

"It should not be surprising that such great quantities of material should come from the interior of the supposed volcano if we take into account that the volume of such a cone, supposing it to be solid in the interior, and with a base corresponding to the diameter of the present lake—that is, about 20 kilometers (12.4 miles)—would be

$$Ar^2 \times \tfrac{1}{3}h = 3.14159 \times 10^2 \times 1.250 = 392.7 \text{ cubic kilometers} = 93.5 \text{ cubic miles},$$

which figures give easily the 42 cubic kilometers (10 cubic miles) of the visible formation and such others as may be submarine, sufficient of it remaining for the conical crust which the volcano would form before submergence.

"It would be interesting to mark the limits with more or less exactitude of the epoch of such prodigious activity of this volcano; and to that effect, from the moment when they began the extensive excavations it was necessary to make in the volcanic tuff for the Manila aqueduct, I begged my dear friend, Señor D. Genaro Palacios, the engineer in charge of those works, that he might give orders to his overseers to collect with greatest care all animal fossils which might be encountered, and I myself have frequently inspected the sections scrupulously, but unfortunately up to the present no animal remains have been encountered. On the other hand, there abound notable vegetable fossils, tree trunks more or less perfectly silicified, and clearest impressions of leaves and branches, those which we have been able to determine up to the present belonging to the present flora (note 2); but I have been unable to find in any of these any vestige of the hand of man, either in the felling of the trees or in artificial forms. Perhaps more assiduous and continued investigations can result in discoveries of this kind which will reveal to some extent the character of the life of this region; in the meantime, with the data collected up to the present (1885), there is reason to suppose that during the long period of formation of this volcanic tufa the country was almost deserted, or at least that those who peopled it were of such a nature that no remains of them have been preserved in the beds of ashes and cinders which enveloped them.

"NOTE 1.—There still remain sharks, according to the natives of the locality, which do not leave these waters.

"NOTE 2.—I possess silicified samples of trunks of *Streblus asper*, *Louvina* (*Calius* of Blanco), leaves of *Psidium guyava*, and the impression of a piece of *Cambu*, gifts from Fr. Celestino Fernandez."

Thus we have presented what I shall call the Zuñiga theory of the Taal Volcano, and this matter is of interest to us here because, whether or not it explains the early history of Taal, the extensive deposits of volcanic tuff in Batangas, Cavite, Rizal, and Bulacan are, at least partly, thus accounted for.

My own notes and observations in these provinces tend to the belief that Taal was unquestionably at a prehistoric period very high and of tremendous activity; that it stood partly surrounded, if not wholly, by a stretch of the sea extending from the Gulf of Batangas to the Lingayen Gulf; that during its activity large quantities of volcanic ejecta fell into this inland sea forming the more or less stratified deposits of tuff now furnishing much of the rich soils of the provinces of Batangas, Laguna, Cavite, Rizal, and Bulacan; that an explosion, or a series of them, blew out the entire upper cone leaving the rim of the present boundaries of the Lake of Taal, and that subsequently minor cones were formed and this region was gradually raised to its present level.

A number of points of similarity between the volcano of Taal and that constituting Barren Island in the Indian Ocean present themselves, and it does not seem at all unlikely that these two exceptionally low volcanoes that are now but most unsightly remnants of their former cones may have passed through similar mighty cataclysms to result in their present similar forms.

The Taal Volcano will form the subject of a later report, in which all information attainable will be presented revised and with photographs.

In connection with the three fossils mentioned in note 2 above I would state here that I find two of the trees (*Streblus asper* and *Psidium guyava*) in the lists of trees that may be felled under regulations of the Forestry Bureau, and one of them (*Psidium guyava*) is on the list of those I observed standing in Bulacan. They are decidedly modern.

The above extensive quotation also illustrates the fact that we must sometimes go far afield for geological data by which to arrive at conclusions concerning a fixed area. The Taal Volcano is in south central Batangas; the tuff deposits of Bulacan are in the south central portion of that province, lying between an alluvial belt of most modern period, geologically, which forms the flood plain of the Rio Grande de Pampanga, including the Candaba swamp, and which borders the bay shore of Bulacan, and the sedimentary deposits of limestones and shells mentioned above of late Tertiary or Quaternary age, which rests upon the core of the foothills and of the cordillera, and which extend partly into the plain. The northern limit of this tuff deposit is at San Ildefonso and the eastern limit curves from a point about halfway between San Rafael and Angat southeast to San Jose del Monte, and from thence beyond the province in the direction of the island of Talim in the Laguna de Bay.

The data for the final age determination of these areas is not yet at hand, and much remains to be done, not only in Bulacan, but in the entire region of central Luzon, before the geological map is possible.

The plain of central Luzon I believe to have been very recently a shallow sea. Upon this point and also in connection with the tuff deposit of Bulacan, we have the following by von Drasche, from his "Data for a Geological Study of the Island of Luzon," a copy of which, in Spanish and corrected by Abella, is in this Bureau:

"From the geological data which are available to-day of the sierra (Zambales), it is difficult to distinguish the point origin of the great eruptions producing the material which, transported by water, have formed the extensive beds of trachytic tuffs; no doubt in the least remains, however, that those which cover the Pampangan plain took their origin in a shallow sea; and, although I have been unable to encounter any fossil remains in these beds in spite of my most careful investigations, these remains have nevertheless been seen at various points.

"Itier, for example, mentions them in his 'Fragments from a Diary of a Voyage to the Philippines,' and in speaking of the numerous masses of pebbles in the Angat River says:

"'It is evident that the deposit of loose lacustrine rocks is, as has been said above, anterior to the appearance of the present volcanic phenomena; and to the disturbance produced by these last it is doubtless due that the waters of the lake ran to the sea, conveying a part of the accumulated pebbles of the lake bed, and furnishing materials which upon being mixed with volcanic remains, constituted the surface of the vast plain of Bulacan, whose subsoil, composed exclusively of volcanic tuff, had been formed in the basin of a sea which became filled, thus explaining the presence of numerous marine shells existing in a fossil state in the peperino of the subsoil of Bulacan.'

"Semper also speaks of this in his sketches, saying, 'in the central plain of Luzon, which in its highest point is somewhat less than 150 feet above sea level, according to the observations of Father Llanos, there is found in many places below the thin stratum of clay, a marine sediment; and in some places, in the province of Pangasinan, to the north of Angat, there are seen lakes of salt water in which should still live mollusks, the same as in the salt or fresh rivers of the same province.'"

It seems more than probable that these theories, and the fragmentary evidence, though I have been unable as yet to find final confirmation of its value, will eventually lead to the establishment of some such geological scheme as the following:

First. At the end of the Tertiary the plain of Bulacan was submerged and formed either an extensive salt lake, a shallow sea, or an open channel; the Zambales Range to the west rising from the waters as an elongated island extending from Cape Bolinao to Mount Mariveles; Mount Arayat standing a solitary volcanic islet in the midst of this sea; and the cordillera and the higher foothills now forming the eastern part of Bulacan, separating this sea from the Pacific and forming part of the Luzon of late Tertiary times.

Second. In the clear waters of this sea corals were living and building the coral reefs, some of which are now found in the form of the range of limestone hills running parallel to the cordillera, to the west of the main range, and extending from the southern part of the province through the Bocol and Baras-bacal Hills, Mount Tucod, Biacna-bato, the range at Sibul de San Miguel de Mayumo, and beyond the province in similar manner to the north.

These corals died from the muddiness produced by river or volcanic sediment, or from the disappearance of the sea by the elevation of the land.

Third. During this period the volcano of Taal was very much higher than it is at present and this, and probably other volcanoes, were very active, ejecting volumes of cinders and ashes that fell into the inland sea, and were transported and deposited in the form of peperino, or volcanic sand, covering parts of the present provinces of Bulacan, Cavite, Laguna, and Batangas. During the intervals of repose the thin beds of sand and clay were deposited which to-day mark the distinct layers of tuff in some places.

Fourth. In the Pliocene or Quaternary there were violent volcanic disturbances that resulted in the submergence or explosion of Taal, the flexure and folding of the strata flanking the cordillera, contemporaneously with the flow of the modern andesites and trachytes.

Fifth. The elevation of the plain beginning probably in the Pliocene, with the exception of the extensive Candaba swamp which is still but little above sea level.

The evidence, such as I have been able to gather in the field and from the records, points to some such sequence as that given above.

As for the Eocene, or earliest Tertiary, I was able to find no sign of it, as indicated by fossils, during my field work; and nothing has yet been found by me in connection with this epoch in Bulacan in any writing I have seen. The nummulitic limestone of Cebu and of Binangonan (the latter in Rizal Province just south of Bulacan) has been the criterion for this epoch in the Philippine geology. But, although I searched diligently for the nummulites in the limestones, I found no signs of them at any time. The few very imperfect fossils I observed in the limestone of the tilted strata in the Bayabas River, just above the Santa Margarita spring, were unrecognizable beyond the fact that from their form they could never have been nummulites. On the other hand, I found a fossil coral, not yet determined, in the limestone rock on Mount Balite, near La Mesa; Itier and Abella and Centeno mention the madrepore corals in the limestones.

In connection with the above I quote from the paper by von Drasche, previously referred to, again:

"We should then distinguish in Luzon, up to the present time, two separate limestone formations:

"First, the Eocene, rarely found, in small isolated beds.

"Second, the modern coralliferous limestones, of great extent, from the north to the south of the island.

"Returning then to the consideration of the terrain of the San Mateo River, as the pebbles are in greater part of syenite, diorite, etc., and as there are but few of trachyte, it can be deduced that the mountain of San Mateo with some exceptions of signs of trachyte is composed of the older rocks, similar to those of the Zambales Sierra, a fact confirmed by the observations of Itier and Jagor.

"The former says: 'In Angat, at the foot of the promontory of the cordillera of Luzon, there exists no sign of the volcanic products and the pebbles which the river carries are of diorite, syenite, *espilita* (?), epidote and porphyry.' Afterwards he adds: 'There is magnetic iron near Angat, and limestones lying in vertical beds and containing *Madrepores*, *Ostreas*, and *Echnoids*.'"

In the "Descriptive Memorial of the Mineral-Medicinal Springs of the Island of Luzon" of 1885, by the commission of which Centeno was the chief, he says, concerning the San Rafael spring of San Miguel de Mayumo: "Great beds of clay and alluvial detritus form the soil in which appear the madrepore limestone which constitutes the geological formation of the hills of Sibul;" and in connection with the San Mariano spring of Norzagaray, he adds: "The greater part of the soil comprehended between the barrio of Matictic and the springs is formed of alluvium, through which appears in places crests of metamorphic rock. Upon reaching the Mabato Creek very hard and compact limestones are seen in which are distinguished, with some confusion, madreporic remains, being precisely in this rock, analogous to that which constitutes the Sibul (San Miguel) Hills, that the appearance is noted of the mineral spring, upon the right bank of the creek and similar to that of San Rafael. Across the creek, and at a kilometer (3,574 feet) approximately from the right bank lies a limestone range, running in this region from southeast to northwest, and which, without any doubt, is the prolongation of the Sibul range."

I found these limestones mentioned above at various points along a line approximately parallel with the western flank of the range. They lie above sandstones and shales, as observed on the exposures of the Bayabas River. This formation, shown in accompanying photographs, dips 26° S., 51° W.

The layers of limestone are from 2 to 4 feet thick, are regularly jointed, and the joints show the effects of erosion to a very marked degree. Among the thin beds is a light cream-colored argillaceous limestone, which shows indications only of imperfect fossils. This exposure is found on the south bank of the river, just above the Santa Margarita spring, and is almost a right section of a portion of the Bocol-Barasbacal Hills cut here by the river. Heavy vegetation covers most of the rock, and immediately west of the tilted strata lies the massive limestone which is most commonly found along this limestone line running through the province. The juncture of this with the thinner beds I could not satisfactorily locate on account of the vegetation and forest growth, but there is every reason at present to believe the beds conformable.

The sandstones and shales lie beneath the limestones and cutting these, and with them in many places lie the modern volcanic rocks, andesites, and trachytes.

Along the line of juncture of the limestones with the volcanics I found the mineral springs of Bulacan. These may be grouped under the heads, those of Norzagaray and those of San Miguel de Mayumo.

In his introduction to the "Descriptive Study of some Mineral Springs of the Philippines" Abella writes:

"In the central plain of Luzon, notwithstanding its rather limited area, the mineral springs are only found at the foot of the cordilleras which limit it, or in the neighborhoods of the volcanic focii which rise in its center, and they constitute two independent and well-defined groups, the eastern related to the cordillera which here is the divide from the Pacific and the western to the Zambales range.

"The eastern group sometimes outcrops from the heart of the early diorites and diabases within the cordillera, and sometimes from the post-Tertiary beds which lie upon, and are elevated by, the trachytes and andesites.

"It is believed that these modern rocks of a volcanic character, upon lifting the strata of the post-Tertiary formation and crossing them in many places, have produced in them foldings, faults, and other geological displacements which have been able to facilitate the hydrothermal mineral emissions and those of the gases which occasionally accompany them; so that certainly an a priori argument can be announced that the mineral springs thus originated should be found in lines approximately parallel to the directions of the anticlinal and synclinal axes of these beds and to the trend of the cordillera upon which they lie. Thus it is, as a matter of fact, and the springs of Sapang Mainit in Pantabangan, of Sibul in San Miguel de Mayumo, and of Sibul in Norzagaray, occur in a right line running north and south, approximately parallel to the direction of the cordillera and to that followed by the outcropping of the beds of conglomerates, sandstones, slates, and limestones which constitute the said post-Tertiary formation of the center of Luzon.

"The springs in the interior of the cordillera, though not completely studied in their greater part, are found in the heart of the older rocks which constitute the range, and they can have been originated by the eruptions of diorites and diabases which are also found at those places, although we certainly must admit the possibility that the faults and paraclases produced by the eruptions of these diorites and diabases, which would serve to conduct the hydrothermal mineral emissions of these epochs, might have been removed and modified by the recent eruptions of trachyte and andesite, the thermality and the composition of the waters which circulated through them being also modified. It is very difficult, in fact, to imagine an absolute and permanent quiet in the regimen of the thermomineral waters of dioritic or diabasic origin, since they have been subjected, in the region occupied by the Island of Luzon, to volcanic and seismic phenomena so potent and general as those which are observed and noted to-day all over its surface."

In my observations in the field I found numerous instances of violent twisting, fracture, and faulting, due in part, at least, to volcanic action and to these andesites and trachytes that form the modern eruptives. Along the Bayabas River, for instance, in several places the stream is choked with tumbled masses of great limestone bowlders, fallen into it, and broken from the strata on the hillsides above; the strata themselves are violently fractured and displaced, the shales farther up the stream are twisted and faulted, and between La Mesa and Bayabas the streams flow at various angles over the synclinal and anticlinal axes of the strata; there are frequent evidences of marked extrusions of andesite and trachyte; and, finally, the escarpments of such cliffs as are seen at Mount Balite, and at points above Bayabas, tend to the belief in extensive displacements, faulting and slipping of the entire strata, leaving more or less gradual and regular slopes upon the west and abrupt faces to the east and northeast, certainly not to be ascribed entirely to the effects of erosion.

The Angat and Bayabas rivers are two characteristic streams of Bulacan, rising in the cordillera and finding their ways through the foothills. These streams all bring down from the sides of the higher hills and of the main range great quantities of pebbles and bowlders of massive crystalline rock. The beds of all the mountain streams that I saw in Bulacan are strewn with these pebbles, and they indicate precisely what von Drasche supposed when he read the statement already quoted of Itier of like effect, viz, that just east of Angat in the higher hills and in the cordillera lies an area of the older crystalline massives. During my tours in these hills I found these rocks in place, thus verifying that portion of Mr. von Drasche's geological sketch map of Luzon whereon he laid down an area of the crystalline rocks in what corresponds to eastern Bulacan. The map referred to, which accompanies the "Data for a Geological Study of the Island of Luzon," and which is on the extremely small scale of 1:1,666,666, contains a number of errors and inaccuracies which perhaps could not be avoided with the means at hand nearly thirty years ago, when this interesting paper was written. My observations of crystalline rock of Mount Calabaza and Mount Pecote, and the Sapa-Santol, Sapang-Bacal, and Maon creeks, therefore, do not verify the boundaries of the crystalline area of Mr. von Drasche, but they do verify the supposition of the Austrian geologist that crystalline rocks lie in place within this area. No mention is made that either Itier or von Drasche ever entered into the hills wherein lie the massives; Centeno and Abella visited the mines, but so far as I know their visits were confined to the mines and were a matter of but a few days, or the time necessary to make their official inspection. In my own case the mines were my objective point, but I gave what additional time I could to the collection of samples of the rocks of this region. My specimens of these and other rocks have not yet been afforded the time and facilities for microscopic and bulk analyses, and they have been subjected merely to my own megascopic analysis. The lithology of these rocks will therefore be held for future reports upon the geology of the cordillera; among them, however, I mention here several specimens of fine-grained diorite, somewhat similar to the rock of Nueva Viscaya (Aritao, Camarin Santa Clara), called syenite by von Drasche, and diorite by Abella. I am not sure, however, that Abella saw the same rock of which von Drasche writes. We have in our bureau museum a sample classified as "syenite" from the precise locality von Drasche mentions, and it certainly appears to me that it is not a syenite, but a quartz-mica diorite or tonalite; and as Abella mentions the tonalites of Panay, I should be surprised if he should call the rock found by von Drasche a diorite (if he saw it), without further modification. Of course, the determination of the feldspar and the microscope will settle this question of the syenites and diorites. Until the final distinction be made I shall call this fine-grained rock with hornblende, and a feldspar that certainly appears to be a plagioclase, a "diorite." Two other coarser-grained crystalline massives, also from Mount Calabaza and Sapa-Santol, are partially decomposed, and a fourth, found in place on Mount Calabaza, is a compact, extremely tough and firmly cemented mixture of quartz and feldspar, without hornblende or mica, and this I shall call, provisionally, "granulite." Another crystalline rock represented by an immense weathered spheroidal bowlder about 12 feet in diameter, resting in a saddle in the Mount Pecote range, seems to be, from its composition and structure, a gabbro. I was unable to find this rock in place during a diligent search on the ridge and slopes of Mount Pecote and elsewhere, and beyond the big bowlder, partly sunk in the ground, I found only one or two smaller ones in the immediate vicinity. These are old, covered with a thin crust of weathering, giving them a dark-brown color. The deposit of laterite or decomposed rock in place is thick here, as elsewhere, and the vegetation is as heavy as usual; so that the obstacles preventing satisfactory exposures are not less evident here than elsewhere in these islands.

In passing, I would state that a fine rose-red trachyte found between Mount Pecote and the Bocol Hills is very similar to that found in a corresponding position to the cordillera in Nueva Viscaya. In fact, judging from all evidence, the western flank of this main divide probably evidences the same conditions through the provinces of Bulacan, Nueva Ecija, and the southern part at least of Nueva Viscaya. The massive crystalline rocks of the core of the cordillera are likewise similar, if not the same, not only by inference but from the evidence of all rock specimens at hand.

Before adding a few notes upon the subjects of fossils and limestone caves, I shall make the following brief summing up:

In Bulacan we find, first, the pre-Tertiary crystalline massives of the higher foothills and of the range; second, the modern volcanics, with, third, the late Tertiary or early Quaternary sedimentary rocks; fourth, the tuff deposits of the plains of recent period; and, fifth, the alluvial belts of the present along the river beds and the bay shore. In the above arrangement according to time we also have roughly an arrangement proceeding from the ridge of the cordillera westward to the shore of Manila Bay.

Some brief mention has been made in the foregoing pages of the fossils of the rocks and deposits of Bulacan. Unfortunately, the evidence at present is extremely meager and unsatisfactory. Age determinations must therefore wait until time and facilities are afforded for careful study of the cordillera, the Zambales range, and the great plain of central Luzon. Paleontological work during my recent brief survey was limited to search for fossils during the few days available from other demands. I was particularly attracted toward the tilted limestones and twisted shales of the Bayabas River, but in them I could find nothing of value as fossils. In the records and in the museum of the bureau I have also been disappointed in my search for paleontological evidence, although to former investigations in fields near by I must acknowledge indebtedness for information that throws light upon our problems here. To Mr. K. Martin, for his work on the "Tertiary Fossils of the Philippines" and to Mr. G. F. Becker for translating and presenting it, and for the suggestions in his valuable report[a] I am especially indebted. The complete bibliography of the geology of the Philippines has not been accessible to me, but to Mr. Becker's résumé of the information readily available to him in Washington I am also greatly indebted as I have been able to use one or two foreign contributions through him that were not available in Manila.

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[a] Report on the Geology of the Philippines Islands, United States Geological Survey, 1899–1900, Washington, D. C.

In summing up it may be stated that but one fossil remains has yet been found that points to an age in the Bulacan strata even as old as the Eocene. This statement does not imply that older strata do not exist; on the contrary, I am strongly of the opinion that they and older rocks will be found, greatly contorted and displaced perhaps by the post-Eocene upheavals. As for the crystalline rocks, there is no evidence as yet to prove that they should not be found to belong as far back as the Paleozoic; and we may eventually find parts at least of the intervening Mesozoic strata, here, as elsewhere, adjacent to the crystalline core of the main ranges. Miocene and Pliocene strata are not definitely known by their fossils in Bulacan, and indeed very imperfectly in the archipelago. I have therefore referred to the later Tertiary and the Quaternary in the foregoing pages, but the distinctions even between these are not definite.

From the history of the coral limestone of other parts of the islands I have assumed that they may be assigned to the later Tertiary or the early Quaternary. The dividing line has not yet been established. The fossil shells of the plain of Bulacan are all of animals now living in the warm seas adjacent to Luzon. The corals of the limestone so extensively developed are also modern. And the only vegetable fossil that I have heard of from this province is one that I found enveloped in a waterworn pebble about the size of a lemon. Upon breaking the pebble to learn its composition I found a vegetable fossil. This has been referred to Dr. J. G. Coulter, expert botanist of the educational department, who has provisionally classed it as the staminate cone of a Lepidodendrid. This find is most interesting and important. If the fossil prove to be a Lepidodendrid, we have here a most pointed suggestion that the early Mesozoic, or the Paleozoic, will yet be found in the Philippines. Final determination of this and other fossils will form material for later report.

The limestone caves of Bulacan deserve rather more than passing mention. They are found in the coral rock extending, as mentioned before, through the province. They are formed, it is hardly necessary to state, by the water courses which originally flowing through the fissures of the rock dissolve the calcium carbonate and so enlarge the passageway, forming immense caverns. The dripping of the impregnated waters through the overlying calcareous formation and through the roof leave by evaporation the stalactites hanging from above and frequently form stalagmites on the floor. The bottoms of the caves are usually waterways, and contain pools more or less extensive, and they are frequently streams with pebbles, sand, and mud. The tendency of the waters of the stream, if it be swift, is to dissolve and erode and so to enlarge the caverns; if it be slow, to dissolve but also to deposit sediment; and the tendency of the percolating waters is to form stalactites and stalagmites if highly impregnated with mineral matter in solution, and to increase the width of the fissures and opening if but lightly charged. Therefore, limestone caves may remain of constant dimensions, theoretically, although this accident of the equation of agencies is of course very rare; or they may be constantly or intermittently enlarging, or becoming filled, depending upon the relation between the amounts substituted or removed.

In Bulacan there are numerous caves from San Jose del Monte on the south to the Madlum Cave on the north. They are all of similar origin but of varying size. The most famous of these caves is the historic Biacnabato, which gave its name to the treaty of 1897 between the insurgent and Spanish forces, and which was an almost impregnable fortress, frequently sheltering large bodies of insurgent troops. A photograph of its entrance appears in the report of the Schurman Commission to the President for 1900. The peaks of Biacnabato rise, rugged and prominent, from the plain of Bulacan. The cave of Madlum is shown upon the sketch map of the Sibul of San Miguel de Mayumo. There are two caves to the southeast of Norzagaray, the exact locations of which I could not learn, one of which was described to me by Lieutenant De Court, who states that it is very extensive, contains deep lakes of water, and is the home of thousands of bats which fly out in such vast swarms when disturbed that the visitor must protect his face and body from them; and the other, described by my guide, Fajardo, is also very extensive, but it is never visited by the superstitious natives who believe it to be haunted. I found time to see two of the well-known caves, one of them in Mount Tucod, on the southwest side of the Pangisijan Creek; and the other, the cave of the Punings, near the barrio of Bayabas.

The Tucod Cave, called by the natives the "iglesia," or "church," consisted mainly of one large room about 50 feet high, from 40 to 80 feet broad, and about 75 feet deep. It is entered from the bed of the creek through two large arched doorways, and clefts run through the roof to the top of the limestone hill separated from Mount Tucod by the gorge cut by the Pangisijan. There is a tumbled mass of rock resembling an altar and great, beautifully colored stalactites, reds and greens, resembling candelabra. The floor is covered with loose sand, pebbles, and bowlders. The cave is self-ventilating in the same manner as are some mines worked by both shaft and tunnel. The cave is constantly enlarging, and from erosion and dissolution of the calcium carbonate by the rain water from above will eventually be open to the sky.

The cave of the Punings is the most interesting and extensive, probably, in the province. It is shown upon the map and is illustrated imperfectly by the photographs accompanying this report. The Sapa-Santol, or Santol Creek, as shown upon the map, rises near the Santa Lutgardac laim, flows around the base of Mount Calabaza, and flowing through Mount Puning changes its name to Puning Creek and discharges into the Bayabas near the barrio of Bayabas. This, like all of the mountain streams, flows through narrow valleys with extremely steep sides, and it carries little water in the dry season, but it is a rushing torrent during the rains. The formation of Mount Puning, which is almost a conical hill, is of coralliferous limestone. The stream, in ages past, found a fissure through the rock and has gradually cut for its waterway a cave over a mile long. The entrance from the Bayabas is a singularly pretty and attractive one. Leaving the Bayabas one follows the Puning Creek upstream, over distorted shales overlaid by limestones, past little cataracts, waterfalls, and deep pools, all overarched by tall trees and climbing vines, and, after following the little valley to the right, one comes into a little open space and is confronted by the side of Mount Puning, rising almost vertically for 50 or 60 feet, and here is the entrance to the cave. The stream has disappeared some distance below, and during the dry season one walks over the sand and pebbles of the creek bed of the rains. For about 400 feet and in the direction S. 70° E. there is a great cathedral-shaped cavern, about 80 feet broad in some places and the point of the arch 150 feet high in many places. During the dry season the water runs beneath the pebbles and sand and the upper floor is almost dry. The bed inclines at a slight angle over this stream bed, the inclination being much more abrupt near the head of the main cave, where there are bowlders and great blocks of the limestone in place. This part of the cave contains many beautiful stalactites hanging from the roof and sides, some of them of greenish and reddish tints and some of them sparkling with millions of little crystals of calcium carbonate. One great stalactite, the Giant, is almost the shape of an inverted turban, and chokes the passage at the point where it hangs, about 400 feet from the mouth. At this place there is a narrow passage running to the northeast, and another, the main passage, running 24 feet to the S. 20° E. 13 feet S. 65° E., and 18 feet S. 30° E., at which point there are many bowlders, a steep incline, and a large, almost perfect basin of marble, containing clear water. The sides of the cave here are of a beautiful bluish-mottled marble. The incline becomes more steep and difficult from this point, and finally, about 75 feet farther, the passage is very slippery and narrow, and here we stopped, our large supply of torches being about spent. The entire length of the cave is something over a mile, and my guide told me that men have been lost in it for two days. The rock floor is covered for the most part with sand, pebbles, and bowlders to the depth of many feet. I found no signs of life of any kind excepting one remarkable spider previously mentioned, and one large black frog. The only fossil observed was a portion of a madrepore coral, broken by me from the rock at the side of the cave. A fairly strong current of air sweeps through the cave in the direction of the water flow, and the coolness, dampness, darkness, and the draft of air, remind one strongly of conditions of a mine.

THE MINERAL INDUSTRY.

The mineral industry of Bulacan is at present confined to the mining and smelting of iron, the washing of the sands of the mountain streams for gold, and the calcining of limestone. Beyond these, I could learn of no activity in this industry of any sort; and these, indeed, are now so extremely limited that they prove an exceedingly insignificant portion of the productive activity in this province.

The history of iron mining in Bulacan is of more than ordinary interest. Romantic incidents are related by Foreman and others, of which we have no records in the bureau, and which will not be enlarged upon here. Of one thing, however, I am quite convinced that some of the most interesting of all the chapters of the history of these mines are those missing from the records, echoes of which are sometimes heard from the natives of Angat, and evidences of which are seen in old abandoned pits, charcoal ovens and slag dumps on the hills and mountain sides. Ruins of houses of the early iron-masters are also seen, and in Angat, Norzagaray, and other towns near by are still to be found old plates and bowls of cast iron, which indicate that in the years gone by the scope of this industry was much broader that it is now. In connection with this subject I quote from Abella, who says, in his "Brief sketch of mining in the Philippine Islands," published in Madrid in 1883:

"Next to gold this metal is the one earliest exploited in the Philippines. There exist abundant deposits of it, the best known being situated on the western flanks of the central mountain range of the island of Luzon.

"Those deposits in the district of Morong were, in reality, first exploited for the purpose of manufacturing munitions of war; and presently those of San Miguel de Mayumo, and those of Angat, in Bulacan, were exploited for the manufacture of mountain knives (bolos), plowshares, and kitchen utensils. These articles were of excellent casting and quality, and were purely for local consumption. Later, at the beginning of this century, an attempt was made to establish a large plant for the exploiting and manufacture of this material, with large furnaces and corresponding machinery; but, as the exceedingly bad roads that this machinery would have to pass over were not taken into account, the enterprise failed even before the working of the mines was begun.

"According to the descriptions of engineers or competent persons who have had occasion to visit them, these deposits are unsurpassed, and they consist of masses—some of them of great extent—of red and brown hematite and of magnetite of excellent quality. Moreover, the situation of these deposits is such that in the immediate vicinity, or very near, may be found an abundance of wood for the manufacture of charcoal and important supplies of water.

"Minerals of this class also exist in Paracale (Camarines Norte), in Caraballo, in the island of Cebu, and in some other points of the archipelago.

"But there are only in actual operation some concessions of San Miguel de Mayumo and of Angat, with small furnaces, which manufacture knives, plowshares, and kitchen utensils, as we have indicated. It is to be hoped, nevertheless, that the exploitation of these minerals may be one of those industries to receive a greater encouragement at some future day."

The earliest record contained in the archives of this bureau with reference to iron mining bears the date December 12, 1781, and is the letter-order of instructions to the "governor of Angat" through the governor of Bulacan from the superior government of Manila, to render every possible assistance to Chaplain Don Juan Belli, of the Royal Armada, in the working of his mine. This curious and interesting document is translated and presented in full in the report of the chief of the mining bureau to the acting civil governor in re the case of the iron mines of Angat. It seems that the chaplain was intrusted by the government with the mining of ore and with the establishment of a smelting plant in the neighborhood of Angat, and that after entering upon the work he found it necessary to complain to the officials in Manila that the natives of his vicinity were unsatisfactory as laborers, and, more than this, that they were ruining the road he had built to the mines by dragging over it the timber they were cutting in the mountains. The reply to this complaint was the very spirited order referred to above, in which the governor of the pueblo of Angat is instructed to prevent the cutting of timber within a distance of 1 league from the mines without express permission, to prevent the use of the mine road for timber haulage by these natives, and to insist that the justices of Angat and others respect the power given to the governor to enforce orders. In this "letter-order" from Señor José Basco to Señor Antonio Brioso, the importance of the development of iron mines is dwelt upon, and the instructions close with the following paragraph:

"It is indispensable that in the extensive development of these islands in all the departments of agriculture, arts, manufactures, and commerce, for all the inhabitants of them to put themselves into action with activity and vigor—a means by which, under the protection of God, we are about to extricate ourselves from the hands of a foreign commerce that is now overwhelming us."

Governor Brioso very thoroughly carried out his orders, and incidentally dealt with the labor problem of those earliest days of mining in a most interesting and decisive manner. He quotes the "letter-order" entire and then follows his proclamation, made from the Royal House of Bulacan, December 14, 1781. He instructs the governor of Angat to enforce the order under pain of fine and suspension from office for failure to obey; and the governor of Angat is further instructed to see that the headmen of the barangays each furnish two laborers a month to the work of the mines and smelters, the men to be paid by the mine manager for their work and to be relieved monthly; all timber already cut is to be removed within twenty days, and after that no timber is to be cut or removed within a distance of 3 miles of the mine; the road is not to be used for haulage by the natives, and any damage done by removing the timber already cut is to be paid for by those causing the damage; and, finally, every assistance asked for by Padre Belli, in the operation of his works, is to be furnished by the officials of Angat as required.

These orders were published as certified to by the town clerk of Angat; "* * * to-day, Sunday, the 16th of December, at 10 o'clock in the day, after the mass, in conformity with that demanded by the decree of obedience, which precedes, I caused to be published, and did publish the letter-order, in public and customary places, by means of the 'war-drum' and people of the guard, through the medium of said governor and the other officers in the presence of many and various people convened at said publication * * *."

Notwithstanding the plans and arrangements for the encouragement of the early iron industry, and the importance given to it, the next records show that it was not making the progress desired. In a second communication from Señor Basco to Governor Brioso we find the following, the receipt of which was acknowledged, and the original of which was forwarded to Angat, on the 3d of March, 1782:

"The chaplain of the Royal Armada, Don Juan Belli, who is at present directing the iron mine denounced in the territory of Angat, represents to me the little or nothing he is able to accomplish in his commission, owing to the indolence and repugnance with which those natives assist in the labor of those works. This mine is of the greatest importance; not only to those who work, but also to the state and the public weal, since, without iron, as we generally find ourselves, it is impossible to possess agriculture, commerce, arts, or manufactures; the construction of boats and edifices, for which above all things, iron is the first requisite. The royal warehouses are devoid of this metal, of which increased amounts are needed on account of the large quantities used in the repairing of ships, works of fortifications and the other equipments for sustaining war, and for the defense of these islands; consideration being fixed on this, and also that it is not in the interest of any one individual (although it may appear thus, the interest of a private individual is not the moving cause in this matter), but rather the service of the King, the common good, and the defense of these domains; you will therefore inform yourself of the causes from which originate the repugnance of those inhabitants to the working of the mine, and you will inform me as soon as possible, endeavoring in the meantime to remove the obstacles that hinder a work so important on the supposition that depending upon the well-founded hopes of this superior authority in said mine, it has failed to ask Batavia for the necessary iron supply, and we are about to find ourselves entirely unprovided if the mine does not produce the end desired."

What the reply might have been to this we are not informed; but we find next that the owner of the mine, who, it develops, was not the chaplain, Don Juan Belli, but Señor Lorenzo Lopez de Buycochea, renter of the cockpits, asks permission to sell his mine because of his advanced age and because of the "accidents" not only to himself but to the director, Padre Don Juan Belli. This was referred to the judge-advocate, Royal Palace, Manila, May 14, 1784, and on the 17th the judge-advocate advised the superior government that there was nothing to prevent the sale, it being understood that the conditions of concession be assumed by the purchaser. On August 7, 1784, we find dated the deed of sale of the mine, works, and all property pertaining thereto, for the sum of ₱11,000, to Don Felix de la Rosa, lieutenant of the Battalion of the Royal Prince.

Upon the map accompanying this report, at the head of the Pangisijan Creek, will be found the site of the old smelter of Buycochea, marked as that of Felix of Valois; and the mine, as near as I can locate it from among the old abandoned workings, is near the place marked "Banca." So far as the records are concerned, this pioneer iron mine of the Philippines was never named, and nothing is known of the dimensions of the property nor of the result of the workings, if even partial success was ever visited upon it.

The next that we learn in chronological order is that Don Santiago Hison, past captain of the Guild of Mestizos of Angat, petitions the gobernadorcillo of Angat, that he be declared the discoverer of a mine on the Sapang-Bacal, and at a considerable distance from the mines of the late Don Felix de la Rosa, and of the Escalantes. (The latter mine is here mentioned for the first time, and is mentioned only in this connection. Its history, dimensions, and production are not known. Some evidences of old works in connection with it are shown upon the map.) On December 1, 1815, we find dated the order of the governor-general of the islands to pass the formal petition of Hison to the fiscal. This petition was undergoing the many processes leading up to the granting of possession, included among which were the summons to the mine owners whose properties were adjacent to that asked by Hison, Don Juan de Escalante y Lazo, and Don Maximo de la Rosa—the former of whom wished his name withdrawn, as the Hison mine could in no way be prejudicial to his interests—when we find the the latter, Don Maximo de la Rosa, appearing in the tribunal of Angat, on February 19, 1816, and opposing the Hison claim upon the ground that he, de la Rosa, who had inherited the old Buycochea mine from his father, the purchaser, had constructed a road for his mining project as far as Sapang-Bacal, and at the cost of his yearly allowance, and that he objected to the use by Hison of the right of way. (This road I believe to be the mountain trail, still the main thoroughfare in this region of difficult travel, which runs along the crest of a hill, separating the waters of the Maon from those of the Pangisijan, on the right flank of which are found the most important iron deposits now worked in these mountains.) Then follows the summons to Don Maximo de la Rosa to appear for the examination, and his failure to do so, later explained in a second and very bitter opposition to Hison's petition, in which he claims that deceit and fraud had been practiced upon him. The petition of Hison went forward, nevertheless; and as the commission appointed to examine the sites of the mines had found and reported that a distance of 135 "brazos" (450 feet) intervened between the place where Don Maximo de la Rosa was taking out ore and the site of the Sapang-Bacal claim of Hison, as Don Juan de Escalante had professed no opposition, and as the various formal steps of the process were one after another complied with by Don Santiago Hison, we find that on the 25th of April, 1816, the commission appointed for the purpose demarcated the claim, 400 Spanish varas square, and placed Hison in possession, "causing the high constable to take him by the hand, and walk with him the circuit of the premises, and in token of royal possession ('corporal velquasi'), a small piece of iron was given to him, in this act, and by means of the interpreters, I ordered that nobody should venture to disturb said Hison in his possession, with which this official proceeding was concluded, and the assistants signed with me." This Hison mine, although at present occupied by American prospectors, has descended to the great-great-grandchildren of the original owner, Doña Maria Alteza Fernando and her brother and sister; nothing further is heard of the de la Rosas, nor of their ancient claim, and Don Juan de Escalante y Lazo, whose mine and works are but barely mentioned, gracefully disappears from the history of these interesting mines of Bulacan.

The history of the remaining claims of Angat, "Santa Lutgarda," "Constancia," and "Sapang Munti," all among the present "first-class" claims, may be briefly summarized.

The Chinese ironmaster, Ong-Sayco, who has worked in the Bulacan smelters for over thirty years and who is to-day the "maestro" in charge of the new Constancia smelter, solicited on March 21, 1873, two pertenencias, which may have been upon the site of the old Buycochea claim, although no connection is made in the records tending to substantiate this statement. Through faults of omission, and because of real or imagined conflict with other claims, no concession was ever obtained by Ong-Sayco. On the other hand, his petition was united as an expediente with that instituted on September 9, 1873, by Don Quiterio Anchuelo Rodriguez, for four pertenencias to be known as the Santa Lutgarda mine. Neither Ong-Sayco nor Don Anchuelo gave precise boundaries or descriptions in their petitions, but it is believed that they both struggled for the same deposit of ore—which lies just south of the old Hison claim and which, from its position, may very possibly have been a relocation of the old Buycochea claim. Notwithstanding the assistance always offered by the officials of the Spanish Inspección General de Minas in the corrections of technical and legal errors, the Santa Lutgarda claim was an unfortunate one and has been the subject of delays and litigation, the fault, it seems, entirely of the claimants. I quote the following from the report of the chief of the mining bureau to the acting civil governor, in re the case of the iron mines of Angat:

"The application of title to the 'Santa Lutgarda' dragged its weary length along from 1873 to 1887 in contest with the 'Ong-Sayco' and with a wanton disregard of the procedure prescribed by law and, as near as this Bureau can tell, the title thereto was never issued at all, although the Spanish authorities apparently recognized it as a valid concession, as appears by the official visits of 1887 and 1893, and the statistical reports of 1886 (1884) referred to in the 'Hison' case. One thing is certain that the 'Santa Lutgarda' does not contain more than one claim, and it is even more certain that it never did contain the land embraced in the 'Hison' grant, or any portion of it; and thus the permission given by Suarez, as the heir of the deceased Anchuelo, is presumptuous to say the least, even if it can not be designated by a stronger term."

The permission referred to above is that given to the American prospectors, Wilson and others, to occupy certain portions of the Hison claim.

The "Constancia" claim of two pertenencias was regularly solicited by Francisca Talag on February 22, 1879, and was promptly opposed by Don Hilario Fernando on the ground that the land solicited was his. After various legal formalities it was shown that the property solicited by Doña Francisca Talag, and that owned by Don Hilario Fernando by inheritance from Santiago Hison, were separate and distinct, and on March 8, 1880, Don Hilario withdrew from the contest. The act of demarcation was performed on June 23, 1880, and on August 13 of the same year the title of concession was granted to Francisca Talag. The two claims of the "Constancia" lie immediately north of the Hison claim as shown on the map. The present claimant is Don Pedro Otayco, whose deed of purchase of one pertenencia from Doña Francisca Talag bears the date of July 27, 1901. The price paid was the remarkably small sum of 200 pesos.

To the north of the Constancia pertenencias lies the single claim of the Sapang-Munti mine. This is on the headwaters of the Monta Muro Creek, whereas the others just mentioned lie in the mountain forming the west side of the Maon. The Sapang-Munti is a new claim and but little is known of it, excepting that it was regularly solicited on November 21, 1892, by Don Francisco Sanchez, and after due course of legal requirements, the demarcation was performed by Señor Abella on April 16, 1893, the entire proceedings terminating without opposition or hindrance whatever. The proprietary title was issued on June 9 of the same year by the governor-general, the proceedings being legalized by the director-general of civil administration; and it was registered by the Intendencia General de Hacienda on June 19, and in the General Inspección de Minas on August 18, 1893. Thus we have the refreshing exception of a mine passing through the various stages to perfection of title, without contest or opposition, within a year. This mine was recently sold, I was informed during my stay in Bulacan, for the sum of 7,000 pesos, to a new owner whose name I can not recall, who proposed to combine forces with the "Constancia" smelter and work the deposit for a time.

This brings to a close the skeleton history of the iron mines of Angat. The mines of San Miguel de Mayumo will be the subject for a later report.

The iron deposits of Angat lie in general in the crystalline rocks of the western flanks of the cordillera. I have never heard of any deposits on the eastern side of the range. Among the spurs and more important hills forming the buttresses of this cordillera there are two crests running roughly parallel with the main range, the one beginning near Mount Buga and running to the west of the Sapa-Santol, or Santol Creek, and its headwaters, the Sapa-Tuyo, and terminating a short distance to the northwest of the Constancia claim; and another, possibly a detached continuation of the former, beginning south of Mount Tincugan and running north to the Pahiripan Creek. The eastern side of the first range, draining into the Sapa-Santol, and the Sapa-Tuyo, the western side of the second, draining into the Monta Muro and the Pahiripan, and the western side of Mount Camanglao and the eastern side of a range without name, both drained by the Maon Creek, contain the iron deposits at present known. It must be confessed from the start that no mines exist in these hills. A mine in the legal sense is an underground working requiring artificial lighting. The light of common day is ample for all purposes at present in the so-called mines of Angat. Nothing more, so far as I have been able to observe, or otherwise learn, has existed in these iron deposits than the mere sinking of shallow pits for distances of from 6 to 30 feet, through the overlying clay and talc to reach the bed, or the "stripping" to equal depth; and it may be added that a large amount of the ore smelted in the past came from bowlders of hematite and magnetite found in the beds of the mountain streams. Old mine pits and trenches have become filled and overgrown with forest growth; and even the present limited workings, as above described, which are ample for the supply of the small number of diminutive furnaces in blast, are so completely surrounded with dense jungle and heavy growth, that the study of the outcrop and strike and therefore any estimate of the extent or continuity of the beds are quite impossible.

All indications seem to me, after visiting and inspecting these isolated workings, to point to a more or less continuous bed, or a series of them, for the Angat country at least. The country rock is massive and therefore no dip and strike of stratification are possible. The dips and strikes and thicknesses, however unsatisfactorily they may have been observed, are variable; but this would be expected even in highly contorted stratified rock. It may be safely prophesied that when stratified formations are found in this region, as I expect them to be, they will be found lying with as many dips and strikes as the iron beds present to-day. Therefore the various dips and strikes of these iron beds as observed do not in themselves constitute an objection to the theory of more or less continuity.

On the banks of the Monta Muro Creek, at Sapang-Munti, and at about the center of the claim, the bed of magnetite is extremely irregular, as elsewhere, and the strike is roughly from northeast to southwest. The bed is from 3½ to 8 feet thick and lies almost vertical. The gangue is iron pyrites with serpentine, lying in bands through the bed. The country rock here is a crystalline slate apparently of diabasic origin.

The bed of ore on the Constancia claim, occurring on the steep banks of a little creek called Sapang-Tibagan, which empties into the Maon, has a strike of N. 30° E. and dips 55° to S. 60° E. The ore is hematite and magnetite and is singularly free from pyrites. Above the bed lies a variable thickness of clay, resulting from the decomposition of the crystalline massives and immediately over the bed and, in the upper portions mixed with it, is found green foliated talc. The general thickness of the pure ore, so far as exposed, is from 5 to 6 feet, and with the mixtures of talc and clay the entire iron-bearing bed may be estimated at from 16 to 18 feet.

At the time of my visits, in March, 1902, there were two pits, one above the other on the hillside, uncovering the ore bed.

Two little mountain brooks flowing down the hillside eastward to the Maon uncover the present and the old workings of the Hison mine. The little streams are roughly parallel and are both difficult of passage. The northern flows over the outcrop of the present Hison workings, where there now stands a cabin erected by the American prospectors mentioned above. This stream is called the Tusig and its rocky course is the only thoroughfare to the outcrop; the problem of transportation here, as elsewhere, is more than likely to be a serious one; but in this connection I may suggest that no difficulty seems to stand in the way of aerial wire tramway carriage. The stream bed is strewn with great bowlders of hematite weighing many tons; and this is precisely the reason that so little development has been done upon these deposits; nature has mined the ore, and the smelter men finding sufficient for their limited needs have naturally not delved for more. The strike and dip of the Hison outcrop, I could not even approximately determine, as the sides of the stream bed are precipitous and heavily overgrown; the outcrop here is the only exposure, and little or no development work has been done. The deposit is from 35 to 50 feet thick—in fact the natives say, probably with reason, that the "mountain is iron"—and although the upper layers are impure with pyrites and steatite, the lower 12 to 15 feet are formed of a compact micaceous hematite with apparently no foreign mineral.

The workings of the "Santa Lutgarda" mine consist of two pits sunk for about 12 feet each through the overlying clay, upon the side of Pinugayan Hill. The upper pit, near the top of the hill, is merely the remnant of an ancient working and no observations could be made there. The lower pit, a hundred yards from the Maon, exposes an irregular bed about 10 feet thick lying nearly vertical, with an approximate strike of N. 20° E. The ore bed carries within it streaks of steatite and serpentine, but I saw no pyrites. This has long been considered one of the purest iron ores of the Philippines. The ore is magnetite and hematite, both compact and massive.

The remaining workings of this Angat district have long since been abandoned, and visits to some of them merely revealed crop falls where the soil and alluvium had fallen in and the beds were completely covered. However much satisfaction I might have derived from uncovering the beds in these old pits and elsewhere, I was unable to perform any work of this sort for lack of time.

The information above presented is very meager and is entirely unsatisfactory to me as data upon which to base an estimate of the extent and value of these deposits. Therefore no such estimate will be attempted. I had hoped to find some development work done, particularly upon the old mines, but, as suggested before, the vast quantity of loose bowlders of smelting ore lying in Moan Creek and in most of its tributaries has rendered unnecessary any more arduous or expensive labor than the breaking of these bowlders and the transportation of them to the near-by furnaces.

As to the extent of these beds, I am strongly inclined, from all obtainable data and from inference of the vast amount of float and the broad area represented by the outcroppings and exposures, to think it considerable indeed. As for the purity of some of them I respectfully call attention to the table of analyses and the discussion following. As for the value of them, it must be remembered that many factors must be taken into account, such as the market for ore or pig iron, the cost and difficulty of mining and of transportation, the purity and extent of the ores, and the cost and methods of smelting. With present means of transportation, with the beds of ore neither prospected nor developed, with the market for iron and the cost of importing and erecting mining and smelting machinery as yet uncertain, it is my opinion that the question of the value of these mines to capital is sufficiently important to justify an array and amount of data for its computation that is not obtainable at the present time. It is well known among mining men that *no* estimate of the value of a mine can be hazarded upon the evidences at the outcrop alone, however favorable. "The value of a mine is the net profit that it will bring to its owner." At this time, therefore, I merely venture the opinion that these beds, being probably very extensive and carrying much ore that is pure, are worthy the development that is absolutely essential for the computation of their final worth.

The accompanying table shows the results of analyses of iron ores of the Angat district, made for me by Mr. Paul Stangl, of the Bureau of Government Laboratories. Reducing the iron determinations to metallic iron by the use of appropriate factors from Fresenius, and adding the respective products, we find:

Total metallic iron.

	Per cent.		Per cent.
No. 1	63.31	No. 5 A	44.16
No. 3	51.85	No. 5 B	60.95
No. 4	59.24		

In the above table I have included the iron represented as disulphide. Omitting this amount of iron, and retaining that from the oxides only, we find:

Metallic iron.

	Per cent.
No. 1	63.31
No. 3	50.10
No. 4	59.24
No. 5 A	37.33
No. 5 B	60.95

It will be observed that No. 1, No. 4, and No. 5 B are ores singularly rich and pure. No. 1 and No. 5 B are practically free from sulphur and phosphorus, those two most objectionable elements, and all three would suggest themselves as suitable for manufacture into high-grade steel by the Bessemer process. The chief impurities are silica and alumina, but these can in no way impair the quality of steel made from them. Extensive tables will be prepared at some future date showing how well these three ores compare with those of other parts of the world. For the present I respectfully refer the reader to tabulated analyses published in the engineering journals, in the text-books on the metallurgy of iron and steel, and in the valuable publications of the United States Geological Survey and those of the surveys of the mining States. In passing, I call attention to the remarkable absence of manganese from all of these Angat ores, and to the presence of cobalt in No. 3.

The above ores as sampled by me were *not* picked specimens. In the table following, in which are given the results of a series of assays made in the laboratory of this bureau in the days of the Spanish Inspección de Minas, it will be noticed that the metallic iron runs higher than in the analyses by Mr. Stangl. This was probably because the ores were sampled from the piles ready for the smelter rather than from the face of the exposure; but of the facts in the case I have no information. Unfortunately the results in metallic iron only are given.

The metallurgy of iron, as at present practiced in these islands, is confined entirely to Bulacan. At the time of my visit to the iron mines of Angat but one furnace was in blast; and in describing the operation of this I shall describe the operations of all, for I could learn of no variation elsewhere in the province from the practice at the Suarez camarin. It gives me great pleasure to acknowledge here the many courtesies extended to me by Señor Mariano Suarez during my visits to his works. He fully answered all of my many questions, and he assisted me in every manner in my measurements, and in the making of sketches and photographs. My facilities for the observation of a furnace in blast were made as complete by him as it was possible for them to be.

The buildings in which the smelting is done are constructed entirely of the products of the forests of the neighborhood. The posts and rafters are of trimmed trunks of trees, the pieces are secured in place by bejuco, or rattan, and the thatching is of cogon or of nipa—thus no metal of any kind is required, and the camarines are made with the bolo as the only tool. These primitive, but well ventilated, inexpensive, and apparently satisfactory structures are illustrated in sketches and photographs accompanying this report. The Constancia camarin was in process of construction during my survey, and it is here shown with the roof partly thatched. The custom in the hills is for the maestro, or smelter foreman, to assemble his assistants, and with them to clear and level the land selected for the smelter site, to dig the clay from the stream banks, bake it into bricks, and from these to construct the furnaces, to cut the required pieces and erect and roof the camarin, to prepare the molds, tuyeres, slag pots, and blowers, to burn the charcoal and sort the ore, to keep the books and to pay the men, and finally to smelt the iron and send forth the finished product. From the uncleared forest to the column of cargadores bearing the plow shares and points to the market, the entire work is intrusted to the maestro and to his assistants. This small industry is a singularly independent one, and so far as I could learn the one requirement of the entire process beyond all that the forests, ore banks, and streams of these narrow mountain valleys could furnish, is a limited amount of boneblack used in coating the molds.

The camarin once constructed is divided roughly into three parts, as shown in the sketch. One side is given up to stalls, or little rooms, in which live the workmen and where are stored the supplies and the furnace products. Another side is divided into ore bins and charcoal bins. The main central space is open and is given over to the smelting proper. In the center of this space are the two furnaces, with bamboo platforms at the sides, upon which the feeders stand, with the tapping holes and slag runways at the front, and with the blower or air compressor and the connecting clay tuyeres behind. Opposite the furnaces runs a row of molds, always placed in position for pouring immediately after the last castings have been dumped.

The furnaces are generally made of sun-baked fire clay, the material being obtained from the decomposition of the crystalline feldspathic rocks of the neighboring hillsides.

In some cases the bricks are molded, and the furnace is built up of these. In others the furnace itself is molded as one piece, dried, and afterwards bound with rattan or iron. The thickness is so great that, nowithstanding the intense smelting heat on the hearth, the rattan, or bejuco, is not burned off. In building the furnace a rectangular space 6 by 8 inches is left above the blow and tap holes, and into these are inserted blocks of a very silicious rock, measuring 6 by 8 by 15 inches, and called buga by the natives. The word buga is surely a misnomer, as it is the Tagalog for pumice. This quartzose rock is quarried near La Mesa for this especial purpose, and the ironmasters pay 2 pesos for each. They are used end about, and I imagine are for the sole purpose of furnishing silica to the slag. That they do furnish silica is shown by the ends of the blocks when removed.

The hearth of the furnace is shallow and nearly circular. It is from 4 to 6 inches deep and about 2 feet 4 inches in diameter. The total height of the furnace is 7 feet 5 inches, measured from the ground, and the distance from bottom of earth to top of furnace is 6 feet. The thickness of the annular ring formed by average right section is 1 foot, although this thickness is slightly greater toward the hearth.

The tuyere is a pipe of best selected and baked fire clay, connected with the blower at one end, passing through the furnace and opening upon the hearth at the other. It is 2 feet 7 inches long, 6 inches in gross diameter, and with an inner diameter of 1½ inches.

The air compressor, or blower, is as ingenious as it is interesting. It is made from the hollowed cylindrical trunk of a tanguile tree and is 9 feet 8 inches long and 1 foot 7 inches in its greatest diameter. One end of this blower rests upon the ground and the other is supported 1 foot 6 inches from the ground by a crosspiece of wood. The ends of the blower are furnished with semicircular valves of leather and wood, suspended from above and closing by the pressure of air against them when the piston moves toward them. The valves are 3½ inches by 7 inches. A separate piece of wood, containing the compartment into which the air is forced and from which it is driven through the tuyere into the furnace, is fitted into the main blower, and made airtight. It contains an opening at each end into the compressor. The connection between the tuyere and the air compartment is frequently a short piece of cast-iron pipe fitted tight. The piston is a circular piece of wood well fitted and carrying around its perimeter a double thickness of feathers. The piston rod is of balite wood, 15 feet long and furnished with a double handle.

The molds for the present smelter practice are of two shapes, and of different sizes for the large, medium, and small castings. These molds are made of carefully selected and ground clay, and the bottom halves are "formed" by means of pieces of narra wood cut to the shapes and sizes of the castings desired. (Analyses of the clays dug from the stream sides and used in the construction of furnaces, tuyeres, molds, etc., are given in Plate XIV.) The inner surfaces are freshly coated for each casting with a paint made of a mixture of boneblack, ground palay, and water. The halves of the molds are placed in wooden frames, bound close together with rattan, and set upon a pair of forked sticks for the pouring. They are well illustrated in the accompanying photographs.

The ore baskets used in feeding the furnace are wedge shaped and are 1 foot 4 inches long, 1 foot 2 inches wide, and 6 inches at the back. The flat baskets used in feeding the charcoal are circular, and 2 feet in diameter and 5½ inches high.

The pouring pot, or ladle, is made of fire clay, bound with iron and furnished with a stout wooden handle. Its inner dimensions are about 8 inches and 6 inches for the larger and smaller diameters, respectively, and 6 inches deep. The few tools, such as pokers, stirring rods for the furnace, and ore hammers and picks for the ore beds, are of wrought iron.

The ore beds are worked, as I have already mentioned, in the open and in the most primitive manner. No system whatever is followed, save the very rudest methods of "stripping" and quarrying. The ore, being broken down by means of crowbars, picks, and small sledge hammers, is carefully hand sorted and carried by cargadores to the smelter. Here it is reduced to a uniform size of about 1½ by 1½ by 1½ inches by means of a small cube-shaped hammer having four breaking edges.

The charcoal is burned near by by the smelter men, who cut the forest trees of the third, fourth, and fifth groups for the purpose. They make an excellent quality of well burned charcoal, and to this valuable fuel much of the success of the native smelters is due.

Before "blowing in" a furnace the hearth and body are filled with glowing fuel, the air driven through, and the furnace well and evenly dried and heated. This being accomplished, the ore and fuel are introduced alternately, the proportion for the preliminary stage being one-half an ore basket, as above described, of metal, to four full charcoal baskets of fuel. After the furnace is well heated, the iron reduced and running upon the hearth, and the blast well on, the normal proportion is thereafter fed to the furnace of one full basket of ore to four of charcoal, and the furnace is kept filled, with a cone of heaped charcoal on top. (In one of the small photographs accompanying this report I have attempted to show the native maestro with his one empty ore basket and the four charcoal baskets.) The air compressor is worked at an average rate of 17 strokes per minute, and the pressure and volume seem ample for the purpose. The process of reduction is comparatively simple, as the ore is self-fluxing and the fuel is very pure, there being no fluxes required whatever, save that from the buga rock, above mentioned. This reduction is caused by the carbon monoxide, which is itself produced by the carbon dioxide of the burning fuel coming into contact with the hot charcoal. The analyses of the slag that I sampled are given in Plate XIII, and it will be noticed that the simplicity of the process is paid for with a loss of 20 per cent of metal.

The slagging of the silica and alumina with a certain proportion of the iron is rapidly formed and escoradores draw off the slag every two or three minutes when the furnace is working well. The pourings are made every two or three hours. The pouring pot is filled, and the meastro passes down the line of molds, with the pot of molten metal, upon which floats a cover of burning charcoal; and he rapidly fills mold after mold. The remaining metal is returned to the hearth. As rapidly as the castings harden in the molds the latter are taken down and opened, the castings thrown out, and the surfaces of the molds are relined with paint and prepared for another pouring. About 15 molds are in constant use by one furnace in good running order, 8 of these for plowshares and 7 for points.

The finished product, as made at present in the smelters, is of the largest size only of plowshares and points. These are exhibited in various positions in photographs accompanying this report; and I have attempted a sketch in which are shown the use of the parts on the Filipino plow. The plowshare of this largest size weighs $4\frac{9}{10}$ pounds. The castings are only fairly good in quality and might be greatly improved.

The expenses and profits of this industry are too variable to be readily ascertained. During the plowing months, May and June, the pair, which consists of a plowshare and a point, bring 1 peso, and the Angat people buy the entire product. During the other months a large part of the product is sent to Manila and is sold here at the rate of from 70 to 90 pesos per hundred pairs. The costs of transportation are variable. Señor Suarez pays the cargadores 1 real for each pair carried from the smelter to Angat, and as each averages about eight pairs he makes 8 reals or 1 peso for the round trip of about 15 miles. When the roads are good it costs 4½ pesos to get 100 pairs to Manila; when they are bad, as in the rainy season, it costs 7 pesos. Because of the shortage of labor, at the wages Señor Suarez can afford to pay, he informed me that he can not get enough men to keep even one furnace in blast. He said that he would work three furnaces if he could get the men. During my visit he complained that we Americans overpaid native labor throughout the islands and that native employers with limited plants could not compete for labor. As it is he must blow out his furnace from time to time to put his limited force to cutting timber for charcoal, to the making of molds, tuyeres, and other supplies, and to general repair work. He estimated four months' smelting a year as good, that is, producing from 2,000 to 3,000 pairs each month; four months, as medium, or producing from 1,500 to 2,000 pairs, and four months, during which time the furnace is largely out of blast, as poor, or producing from 800 to 1,000 pairs.

The laborers required for one furnace are almost as many as for two and are 2 maestros or foremen, who have general charge, 1 escribiente, or clerk, 2 escoradores, or slagmen, who also act as brajenantes, or molders, 4 heladores, or blowers, and from 4 to 7 other common laborers who obtain and prepare the ore and fuel. These men are "found" and are paid by the amount produced, the unit being 60 carabao loads of 20 pairs each. Señor Suarez told me that the food he gave the men depended upon the quantity and quality of their work, and that when everything was running well and the output steady and large he fed them with the best he could buy. He estimated that the cost to him in food and wages, for men enough for one furnace, averaged about 60 pesos a month during the working season, or about 40 pesos through the year, and that the variation was between 20 and 100 pesos. His annual taxes during the Spanish régime were 115 pesos to the General Government and 48 pesos to the pueblo of Angat. He seemed much concerned over the cost that his fuel would be to him under the present Forestry Regulations. He stated that he cut only the cheaper grades of trees for charcoal, and yet, upon looking over the taxes imposed at the present scale, he said that he would be compelled to shut down if he were forced to pay the full amount. I could get no statistics whatever upon this subject of the cost of his fuel, and this is a matter of regret to me because it is a most essential factor in the operation of furnaces in this region upon a larger scale.

With the above incomplete data I have attempted to form some sort of estimate of the profits of one furnace, run under unfavorable conditions. With more furnaces and improved methods the profits would correspondingly increase. One great difficulty in the attempt at an estimate is the division of product as to place of sale, the profits being greater when the plowshares are sold in Angat. The following is intended to be more suggestive than accurate.

Estimate of profits from one blast furnace.

	Mexican currency.
Sale of 6,000 pairs in Angat at $0.90	$5,400.00
Sale of 14,000 pairs in Manila at $0.75	10,500.00
Annual receipts	15,900.00
Transportation of 6,000 pairs to Angat at $0.12½	750.00
Transportation of 14,000 pairs to Manila at $0.70	9,800.00
Wages and food for employees for 20,000 pairs	1,000.00
Taxes under Spanish régime	163.00
Annual expenditures	11,713.00
Annual profits	4,187.00

In the above no account has been taken of cost of mine and plant.

The latter, of course, costs very little indeed. There is, and has been, so much unfortunate litigation and quarreling over these mines and camarines that no data on the subjects were obtainable.

It would seem that if a market could be assured for a large output of these plowshares and other castings, or of pig iron of high grade, if charcoal can be had at reasonable rates or if our islands can furnish lignite of a quality to give good producer gas, if the transportation rates can be materially reduced, and if competent labor can be secured, that a large modern furnace smelting the best of these ores could operate at a handsome profit to its owners. I am inclined to think that the above conditions can be satisfactorily settled and that there is a future for the iron industry in the Philippines.

Herewith I give the only statistics available of iron production in Bulacan. The information is for the year 1884 and was furnished by the governor of Bulacan on February 4, 1886.

Statistics of iron production in Bulacan, 1884.

Pueblos.	Number of furnaces.	Number of plowshares.	Number of operatives.
San Miguel	3	20,000	25
San Miguel	2	10,000	10
Angat	2	12,000	18
Angat	1	8,200	14
Angat	1	8,200	14
Total	9	58,400	81

Of the remaining factors in the mineral industry of Bulacan, unfortunately but little could be learned. This province has undoubtedly produced some placer gold in past years, but no statistics whatever are available. Some months ago a prospector showed me several ounces of rather coarse placer gold that he said came from the hills of Bulacan, but he offered no information whatever as to the location. This reticence at that time was of course most natural; there was then absolutely no legal protection whatever for these men in their finds. Several prospectors whom I met in Bulacan told me that they had washed the sands of many of the streams, but had found nothing excepting in the hills to the north of Norzagaray, where there was some placer gold. My guides frequently spoke of gold in the streams, but their descriptions were too vague to be of any worth. José Fajardo told me that a small sapa, or stream, emptying into the Angat, just above the town of that name, carried gold, and that he had staked out several claims. He also said that the Sapa Apo, which was very indefinitely described, at one time carried a great deal of gold. And so there are rumors, and tales that are told, but of definite information there is nothing. The purposes of my survey were either unintentionally or willfully misunderstood by some of the American prospectors, and I therefore made it a point to confine myself to information that I could readily obtain without misunderstanding of any kind, knowing that professional prospectors are the best seekers after gold, and that their discoveries, under the protection of mining laws, would soon furnish the information desired. I fully expect to hear of discoveries of both placer and quartz claims in the upper hills of Bulacan.

Graphite pebbles were found by me in the bed of the Pangisijan Creek, near Mount Tucod. No further evidences of a deposit was obtained, although I examined the headwaters rather carefully for them. Among the metamorphic rocks of the cordillera there probably exists deposits of this valuable mineral.

Lignite of a very inferior grade and in thin seams has been formed in the shales of Bulacan. I saw two of these seams, one at the barrio Sampaloc, in the shales exposed by the Bayabas, and one on the upper Sapa-Santol. They were absolutely valueless, neither being more than a few inches thick. An inferior lignite is also found in the arroyo Laguio Malaqui, near Norzagaray. No coal mining has ever been done in this province, and no concessions for coal have ever been granted here. The importance of a good lignite in Bulacan, capable of furnishing producer gas for future iron smelting, can not be overestimated. In Rizal Province, under conditions similar somewhat to those in Bulacan, an excellent gas-making coal has been discovered in quantity. It is possible that such deposits may yet be found under the coral limestone formations of Bulacan. It is notable, in this connection, that no valuable coal has yet been discovered in the mountains east of the plain of central Luzon, with the single exception of reported finds near Baler, on the Pacific coast.

Building stone of good grade and great beauty can be quarried from the crystalline rocks of the range. The tonalites, or the fine-grained quartz-diorites, and the aplite, would make handsome stones, capable of receiving high polish. The development of this industry, however, must indefinitely await a demand for the stone and for better transportation facilities.

Vast quantities of limestone are available in Bulacan for use as road metal, as furnace flux, as building stone, and for the working of lime. The latter is the only purpose for which limestone is now used, and this branch of the mineral industry is practiced, as far as I could learn, at Banabang only, on the Bayabas River, near Angat, the range of hills, of which Mount Pecote is a prominent part, showing extensive exposures of a fine-grained, cream-colored limestone on their western slopes. This rock is not regularly quarried, but the large slabs and bowlders of the rock lying on the surface of the ground are broken and carried to the kiln at Banabang, a half mile to the west. This limekiln is fired up only when there is a sufficient demand in Angat or in some of the other towns for several hundred pounds of lime. It is owned and operated, I was informed, by five natives, residents of Angat. These partners in the business do all the work of obtaining and hauling the stone and fuel, and of digging and puddling the clay required for building up the sides. There is therefore no expense for labor, and, as they pay nothing for either stone or clay, the expense account is practically that of the fuel. The native operators use dried bamboo stalks for fuel, and they say that by burning these they can obtain a hotter fire than with wood or charcoal. The stalks are cut in lengths of 4 feet and are piled like cord wood near the kiln. The unit of measurement and of payment is the "talacsan," which is 1 vara long, 1 vara high, and 4 feet wide. The requirement for one firing is 60 "talacsans," which cost 1 peso each. The average product of lime in one firing is 300 cavans, or about 640 bushels. The lime is of excellent grade, and now sells in the towns for a peso a cavan, whereas in the days of the Spanish régime it brought but a peseta a cavan. Therefore for one firing, producing 300 cavans, worth a peso each, the total cost of which amount is 60 pesos, the profit is evidently 300—60=240 pesos. This divided among five men yields 48 pesos each for 15 days of work. There is apparently a comfortable profit to the owners in this small business. The lime made by them is fine and white, and has a very good reputation in the towns, and is in fair demand. It has not been used in agriculture, so far as I could learn.

The process is, of course, a very simple one. The limestone, or calcium carbonate, being properly heated in a partially closed oven, gives up its carbon dioxide, and remains as calcium oxide. A sketch is shown herewith, exhibiting the principal dimensions of the kiln. The body of the oven is below the surface of the ground, as is the firing box. The hole from which the lime is taken opens upon the bank of the stream just above the road, so that loading upon carts is readily facilitated. The red clay dug from the fields is puddled by foot. The slabs of stone are piled in the form of a hive, with a hollow space within and with an opening into the firebox. When the arrangement is complete, the outer surface is covered with straw for 3 or 4 inches, and over this is carefully plastered the clay to the same thickness, with a series of holes through the shell for draft. The draw hole is then tamped with clay, the kiln is gradually heated, and finally the proper degree of heat is obtained and continued to the end of the operation. The draw hole is opened from time to time for the removal of the ashes. The firing requires eight days and nights of continuous attention, and the preparation for each burning requires seven days of labor. There were formerly two kilns in operation at Banabang, but at the time of my visit there was but one.

CONCLUSION.

Before concluding this report I wish to repeat my appreciation of the work of Mr. Martin, the photographer of the bureau of government laboratories, whose photographs accompany this report. Mr. Martin's work speaks for itself, and it is a pleasure to record the fact that with him exist the combination of exceptional ability and devotion to the good of the public service.

Should the government ever take steps toward the setting aside of certain public lands as parks, in order to preserve whatever unusual natural beauty may be found therein, I beg to call attention to the Puning Cave and that part of the valley of the Puning Creek immediately adjacent.

In summing up the geology of Bulacan I refer again to the fact that the crystalline massive rocks have been found in place in the cordillera, which fact confirms the hypothesis of Itier and Von Drasche, and which settles a point apparently in doubt during the compilation of the "Geology of the Philippine Islands," by Prof. G. F. Becker, of the United States Geological Survey. I further call attention to the finding of a vegetable fossil, encased in a pebble in the stream bed of the Bayabas, which, I believe, is the oldest fossil in point of geological history yet discovered in the Philippines. It apparently points back to the early Mesozoic, possibly to the Paleozoic.

The mineral resources of the province have been as fully discussed as time and the data obtainable would permit. The interesting method of smelting the iron, which is over a century old, and the origin of which I have not ascertained, is fairly well illustrated by sketches and photographs.

For ready reference I have given lists of illustrations and photographs and a skeleton index of the report.

In conclusion, I beg to express the hope that this preliminary field work may but be the first of many surveys and studies to be prosecuted by this bureau; that the future work may be broadened and its usefulness increased by an added force to the personnel, so that with a division of labor a much greater amount of work can be performed; and that, finally, the earnest efforts to make the results of this first survey of value may have so far been successful that encouragement may result for extensive work in the future in the study and development of the mineral resources of the Philippine islands. Capitalists are always willing to pay, and to pay well, for mines, quarries, or other mineral deposits that they know to be of worth; the discovery and development of these, fair and honest reports upon them, and inducements to capital to invest in them will result in largely increased business in these islands, in better transportation, in better wages, in a natural pride on the part of the natives in the value of the metallic wealth hidden in their hills, and finally in such an increase in industrial prosperity as could never have been known had not the capital and brains of the outside world been invoked to that happy end.

Respectfully submitted.

Hiram Dryer McCaskey, B. S.,
Mining Engineer for the Mining Bureau.

Mineral medicinal springs of Bulacan.

	San Rafael, San Miguel de Mayumo.	Santa Matilde, San Miguel de Mayumo.	San José, San Miguel de Mayumo.	Dilain, Norzagaray.	San Mariano, Norzagaray.
Density at 760 mm. pressure, 0° C	0.998443	1.004637	1.004170	1.007789	1.001062
Temperatures of waters and air:					
Water ... degrees C	28	29 30	27	26 26.5	26.5
Air ... do	26.5	26.5	26	26	26
Flow per second ... liters	73.00	....	.02	....	.77
Composition of water:					
Nitrogen, grammes per liter	.026900	.025788	.012689	.021119	.020587
Oxygen..grammes per liter	.002812	.005240	.004366	....	.002130
Chlorine ... do	.029752	.053683	.037537	4.300574	.418578
Sulphuretted hydrogen, grammes per liter	.001175	.001947	....	.032461	.001622
Carbonic acid, grammes per liter	.420404	.531667	.357960	.221680	.424000
Sulphuric acid, grammes per liter	.007049	.015107	.024034	.045664	.013047
Silicic acid, grammes per liter	.026683	.014600	.012200	.010400	.019600
Phosphoric acid, grammes per liter	....	....	....	.000200	....

Mineral medicinal springs of Bulacan—Continued.

	San Rafael, San Miguel de Mayumo.	Santa Matilde, San Miguel de Mayumo.	San Jose, San Miguel de Mayumo.	Dilain, Norzagaray.	San Mariano, Norzagaray.
Composition of water—Cont'd.					
Ferrous oxide, grammes per liter	Traces.	...	...	...	...
Ferric oxide, grammes per liter	...	0.012400	0.015200	0.002600	0.065600
Aluminium oxide, grammes per liter	...	.023200	.006800	.161200	.006000
Calcium oxide, grammes per liter	0.208456	.180656	.190400	1.162673	.213919
Magnesium oxide, grammes per liter	.022691	.053886	.036021	.270161	.030018
Sodium oxide, grammes per liter	.022714	.043453	.020561	2.222973	.268349
Potassium oxide, grammes per liter	.002131	...	...	.025042	...
Organic matter, grammes per liter	Traces.	...	Traces.	Traces.	Traces.
Fixed residue, grammes per liter	.472300	.574000	.481000	7.346000	1.066000
Classification	Hypothermal. Sulphydric. Calcium bicarbonated. Nitrogenated.	Hypothermal. Sulphydric. Calcium bicarbonated. Nitrogenated.	Hypothermal. Ferruginous. Bicarbonated.	Hypothermal. Sulphydric. Sodium calcium chlorinated. Nitrogenated.	Hypothermal. Sulphydric. Calcium bicarbonated. Sodium calcium chlorinated.

Analyses of some iron ores, jurisdiction of Angat-Bulacan.

[By Mr. Paul L. Stangl, analytical chemist, bureau government laboratories, Manila.]

	No. 1, hematite.	No. 3, hematite.	No. 4, magnetite.	No. 5A, hematite and pyrites.	No. 5B, hematite.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
FeO	1.922	5.143	32.344	4.720	2.570
Fe_2O_3	88.225	65.862	48.691	48.078	84.215
MnO	...	...	...	...	...
CaO	.126	5.040	Trace.	1.930	.250
MgO	.183	1.513	1.311	.465	.093
Al_2O_3	6.523	10.100	15.340	12.200	8.670
FeS_2	...	3.754	Trace.	14.657	Trace.
CO_2	.010	...	Trace.	.032	Trace.
H_2O	.041	.370	.035	3.212	.340
SiO_2	2.240	6.719	2.184	14.137	3.853
P_2O_5	Trace.	.243	.053	.143	Trace.
TiO_2	.770	Trace.	.106	.513	Trace.
CoO	...	1.039	...	...	...
Total	100.040	99.983	100.064	100.087	99.991

NOTE:

No. 1. Micaceous ore from Hizon mine. Soft and unctuous at outcrop.
No. 3. Compact, brittle. Luster metallic. From Constancia mine.
No. 4. Crystalline, massive. Constancia mine.
No. 5A. Second-class ore. Upper bed mixed with pyrites. Constancia mine.
No. 5 B. First-class ore. Lower portion. Constancia mine.

Assays of iron ores made in the laboratory of the inspección de Minas, Manila, P. I.

Location.	Town.	Province.	Description of mineral.	Streak.	Metallic iron.
					Per cent.
Hison	Angat	Bulacan	Fine grained, black	Black	68.47
Hison	do	do	Granular micaceous, black.	do	69.45
Santa Lutgarda	do	do	Foliated, Calcose reddish.	Violet-black	67.48
Do	do	do	Fine grained, reddish	Brown-red	65.51
Constancia	do	do	Reticulated, white (?) black.	Black	60.34
Bato-balain	Paracale	Camarines	Compact, black	Black-brown	68.08
Montamuro	Angat	Bulacan	Fine grained, black	Black	67.48
Rio Lanatin	Bosoboso	Morong	Compact, blackish	Black-brown	66.08
Sapang-Bacal	S. Miguel	Bulacan	do	Violet	66.00
Calambayungan	Mambulao	Camarines	Compact, brown-black	Brown-red	65.33
Do	do	do	Compact, blackish	Brown-yellow	63.84
Santa Ynes	Bosoboso	Morong	Compact	Chocolate	53.41

NOTE.—This table is presented translated as it occurs in the laboratory record of the Spanish Inspección de Minas.

Analyses of some limestones, jurisdiction of Angat-Bulacan.

[By Mr. Paul L. Stangl, analytical chemist, bureau of government laboratories, Manila.]

	No. 8.	No. 9.	No. 13.
	Per cent.	*Per cent.*	*Per cent.*
CaO	48.8830	52.4230	43.7160
MgO	1.0064	2.1308	3.8641
Al_2O_3	6.8530	.5735	3.0727
FeO	.1134	.2650	.4540
Fe_2O_3	.2270	None.	.1586
SiO_2, soluble	.2920	.1420	.3230
SiO_2, insoluble	1.2610	.4130	7.3730
CO_2	39.6685	42.2200	37.7958
P_2O_5	.5330	.1212	.5907
S	.1020	.1734	.2421
H_2O	.2000	.2500	1.0300
Organic matter	.2420	.4320	1.1270
MnO	.2030	None.	.3030
BaO	.3689	1.1699	None.
Total	99.9532	100.3138	100.0500

NOTE:
No. 8. Santa Margarita spring, Bayabas River.
No. 9. Banabang, Bayabas River.
No. 13. Santa Margarita spring, Bayabas River.

Analyses of blast furnace slag, jurisdiction of Angat-Bulacan.

[By Mr. Paul L. Stangl, analytical chemist, bureau of government laboratories, Manila]

Qualitative analysis gave following constituents: As, Fe, Mg, Al, Ca, SiO_2, C, S, P, Cl, Na, K, Mn.

Mechanical separation gave 1.6525 per cent metallic iron embedded in slag as granules and a large amount of carbon in form of charcoal.

Quantitative analysis gave: SiO_2, 42.028 per cent; MgO, 2.310 per cent; Al_2O_3 23.583 per cent; Fe, 19.2122 per cent (calculated as Fe_2O_3, 27.446 per cent).

NOTE.—This slag, taken as representative, from the slag heap of the Santiago Camarin is of a vitreous green appearance, containing embedded pieces of charcoal and granules of iron, and shows imperfect fusion and great loss of metal.

Analyses of some clays, jurisdiction of Angat-Bulacan.

[By Mr. Paul L. Stangl, analytical chemist, bureau of government laboratories, Manila.]

	No. 6.	No. 11.	No. 12.
	Per cent.	*Per cent.*	*Per cent.*
SiO_2	69.08	74.50	60.24
CaO	4.10	2.92	.47
MgO	Trace.	Trace.	.05
Fe_2O_3	2.64	2.61	4.15
MnO		1.79	Trace.
TiO_2	Trace.	Trace.	
Al_2O_3	21.57	15.17	20.05
K_2O	.46	.53	1.44
Na_2O	.04	Trace.	3.18
H_2O	2.63	2.43	11.27
Total	100.52	99.95	100.85

NOTE:
No. 6. "Constancia," camarin, cream white, showing free quartz.
No. 11. "Constancia," camarin, cream white, showing free quartz.
No. 12. "Constancia," camarin, light brown, for brick.
These clays are used in the making of furnaces, tuyeres, and molds.

Analyses of a diabase and of the "buga" sandstone.

[By Mr. Paul L. Stangl, analytical chemist, bureau of government laboratories, Manila.]

	No. 7, diabase.		No. 2, "buga" sandstone.	
	Acid soluble.	Total.	Acid soluble.	Total.
SiO_2		46.63		86.91
Al_2O_3	16.59	24.73	1.01	3.92
Fe_2O_3	3.96	4.06	.12	.25
FeO	2.24	2.24	1.07	1.07
CaO	3.45	8.03	.52	3.25
MgO	.56	.57		.12
Ma_2O		7.80		1.96
K_2O		.97		1.66
Loss		4.97		.86
Total	26.80	100.00	2.72	100.00

NOTE:
No. 7. Fine grained, Sampaloc, Bayabas River.
No. 2. Cream brown, Buga Mountain, near La Mesa Barrio.

NOTE.—The following illustrations accompanying this report are on file in the War Department:

PHOTOGRAPHS.

PLATE A. Camps of the Survey.
B. Transportation of the supplies.
C. Native *maestro*, with ore and fuel baskets. Furnace in blast.
D. Limestone beds. Bayabas River above Santa Margarita Spring.
E. The same as D. Nearer view.
F. The "trail" up a branch of the Maon Creek to Hison mine.
G. The bed of ore at the Hison mine.
H. The bed of ore at the Otayco (Constancia) mine.
I. Camp Burritt.
J. Nearer view of ore bed of Constancia mine.
K. Folded limestones and shales. Bayabas River, La Mesa.
L. Ore beds of old Hison mine.
M. Preparation for charcoal burning. Suarez camarin.
N. Face of stripping to uncover ore bed. Hison mine.
O. Ore bed. Constancia mine.
P. Hills and plain. From Mount Calabaza toward Manila.
Q. The Otayco camarin.

PLATE R. Interior of Suarez camarin showing tuyeres and molds.
S. Interior of Santiago camarin. Piston, tuyeres, and blower.
T. Interior of Puning Cave.
U. Plow point in center. Shares of two sizes.
V. Same as U.
W. Same as U, back view.
X. Looking down Bayabas Valley from La Mesa Barrio.
Y. La Mesa Barrio.
Z. Panorama from Mount Maquina looking northeast and east. Mount Cutad to the left, Mount Puning in the center. General view of La Mesa Basin.
AA. Panorama from Mount Maquina looking northwest, west, and southwest. Mount Tugod to the right. Mount Sampaloc to the left. Angat River and Plain to extreme left beyond range of hills.
AB. Panorama from lower point on Mount Maquina, showing Mount Sampaloc to the right, Mount Pecote in center, and Mount Balite in left foreground.
AC. Mount Tincugan from Mount Calabaza.
AD. Mountains and forests. From Mount Calabaza looking east to Mount Pilong Pilong.
AE. Panoramic view of Angat River from north bank, looking toward town.
AF. Limestone bowlders in Bayabas River just below Camp Burritt.
AG. Limestone rocks in part in place. Bayabas River.
AH. Trail on Mount Calabaza leading into forest.
AI. Preparations for charcoal burning. Suarez camarin.
AJ. Bulacan blast furnace. Blower removed.
AK. Santiago camarin on Constancia claims.
AL. Entrance to Puning Cave.
AM. Camarin of Maria Fernando, in course of construction
AN. Molds for casting plow points. Suarez camarin
AO. Tilted limestone beds. Bayabas River across the stream from Santa Margarita Spring.

MAPS AND SKETCHES.

PLATE 1. Map showing the iron region of Bulacan.
2. Map of the vicinity of Sibul, San Miguel de Mayumo.
3. Map showing location of the springs of Sibul.
4. Sketch of limekiln, Banabang, Bulacan.
5. Sketch of a Bulacan iron camarin.
6. Sketch of a Bulacan blast furnace.
7. Sketch of furnace showing blower or air compressor.
8. Sketch of Filipino plow, showing share and point.

MINING BUREAU.

(Bulletin No. 4.)

A PRELIMINARY RECONNOISSANCE OF THE MANCAYAN-SUYOC MINERAL REGION, LEPANTO, LUZON, P. I.[a]

By ARTHUR J. EVELAND.

LETTER OF TRANSMITTAL.

THE MINING BUREAU,
Manila, P. I., October 19, 1905.

SIR: I have the honor to transmit herewith, recommending its early publication, the material prepared by Mr. A. J. Eveland, geologist, mining bureau, for Bulletin No. 4 of this bureau, entitled "A Preliminary Reconnoissance of the Mancayan-Suyoc Mineral Region, Lepanto, P. I."

This result of the first field work by Mr. Eveland, in difficult Philippine fields, should be of value to those interested in the mineral resources of these islands and, in my opinion, reflects much credit upon Mr. Eveland and the party under his charge.

Very respectfully,

H. D. MCCASKEY,
Chief of the Mining Bureau.

Hon. D. C. WORCESTER,
Secretary of the Interior, Manila.

LETTER OF SUBMITTAL.

THE MINING BUREAU,
Manila, P. I., March 28, 1905.

SIR: I have the honor to submit herewith the manuscript of a preliminary report on the mineral deposits of the Mancayan-Suyoc region of Lepanto Province, island of Luzon, P. I. It has been prepared for publication as a bulletin of the mining bureau.

Very respectfully,

A. J. EVELAND, *Geologist.*

Mr. H. D. MCCASKEY,
Chief of the Mining Bureau, Manila, P. I.

CHAPTER I.

INTRODUCTORY.

FIELD WORK.

The field work upon which is based the following preliminary report on the mineral deposits of the province of Lepanto, Luzon, P. I., occupied the latter part of the "winter" season of 1903–4, and from early in March to the middle of June. This period of three and one-half months may by no means be taken as the time available in the investigation of the area, as the early advent of the rainy season rendered work impracticable approximately one-half of that period, the daily torrential rains terminating field work with unfailing regularity. In addition to the time spent actually in the field, six weeks were required for transportation to and from Manila, and at the close of the season's work, discontinued when it was absolutely impossible to do more;

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[a] The illustrations mentioned in this report have been omitted and are on file in the War Department.

one section of the party, with the collections and equipment in its care, occupied six weeks in the return to Manila.

Topographic mapping has as yet not been undertaken in the Philippine Islands. Only to a small extent has any primary triangulation work been carried on, and that only on the coasts and harbors, under the United States Coast and Geodetic Survey. The party was therefore organized as completely as possible under the conditions, for varied and general work, and consisted of the writer as geologist and chief, with Mr. H. M. Ickis and Mr. M. Goodman, field assistants, and two rodmen. The absence of one field assistant was unavoidable for over a month, and the connection of one rodman with the party was severed almost immediately upon reaching the field, so that the party practically consisted of the geologist in charge, with one field assistant, one rodman, and such native (Igorot) labor as could be obtained, for the major part of the time.

No detailed investigations, except such as could be profitably carried on with the limited force and time at hand, were contemplated. The region which was to be visited has been long prominent in the infant mineral industry of the islands, and only such work that would give a better and fuller knowledge of the mineral resources of the region and an aid to those interested in its development and future progress was undertaken.

For these and other reasons this report is not comparable with more extended and detailed studies, which, it is hoped, are to be undertaken in the near future, but attempts to approach more closely such reconnoissance work as was carried on with wonderful success by the United States Geological Survey in Alaska. Indeed, the conditions of Alaskan work are not greatly dissimilar to the conditions under which all scientific field work is accomplished in the Tropics. The lack of transportation facilities is one of the worst evils to deal with. For every item in the equipment and supplies of use during a more or less extended field trip there is a problem large in its proportions. In the present work the absence of horses or any pack animals thrusts the burdens, literally, on the shoulders of mankind. And the Asiatic races, while much may be said in their favor, do not, as a rule, take kindly to continued labor.

In carrying on geological work one meets with the excessive vegetation of the Tropics, limiting one's vision to a matter of feet, and, in correspondence, the great thickness of soil and decomposed rock material render the solution of even the most simple stratigraphic problem a labor in itself. And considerably not the least in proportions are the climatic conditions which Europeans have to face.

In view of these conditions therefore the report submitted is to be understood to be purely preliminary in scope, and the results and deductions based upon it may possibly be subject to future revision and modification when more detailed investigations are carried out.

The actual route, which is indicated in the index map (Pl. I), and means of transportation of the party are briefly as follows: From the map it will be seen that the area indicated lies approximately 160 miles almost due north of Manila. The railroad from Manila north at present only reaches Dagupan, in the province of Pangasinan. As the most direct means of reaching the territory, then, the party, with its outfit, provisions, and other equipment, was embarked February 24 on the coast guard steamer *Masbate* and on February 27 was disembarked at Candon, in the province of Ilocos Sur.

The trail inland, up the valley of the Balidbid River to Salcedo, north along the western flank of the Cordillera del Teila to Concepcion, then over the Teila Pass to Angaqui, and south to Cervantes, in the valley of the Abra River, presented no other difficulty than lack of transportation. Owing to delays in securing "cargadores" it was not until March 6 that Cervantes, the capital of Lepanto-Bontoc province, was reached; but finally, on March 11, the first permanent camp of the mining bureau party was pitched at Mancayan, the "barrio" or village which was the seat of mining operations of considerable importance in the past.

For two months Mancayan was made the base of operations for that portion of the mineral region. At the end of about that time camp was shifted to Suyoc, some distance to the south, from which the operations were completed.

It may be well to give a brief résumé of the work done, in order that the understanding may be fully clear.

Of prime importance to any geological work, the topographic base map merits the first consideration. As the relative position of this area could not be determined from any previous maps or data, recourse was had to astronomical methods, and permanent monuments erected on determined points. Checking on these, a base line was laid out, according to the customary procedure, with its conjunctive system of tertiary triangulation over the area. On account of the numerous claims recorded and the evident disposition of the mining fraternity to develop and operate this district, a rather detailed topographic map of a region about 6 miles long and 4 miles wide, on a scale of 400 feet to an inch, was made. It is believed that this map will be of inestimable value to future development work in this district, and therefore more attention was given to it than the general character of the investigation would seem to call for.

The general investigations were conducted along three distinct lines, viz:

(1) A hasty reconnoissance of a large area considerably beyond the immediate vicinity of the "mineral region."

(2) Route surveys, from the coast to the mineral region, by two distinct routes.

(3) A detailed study, as far as the operations permitted, of the ore deposits and geology of the district proper.

In connection, data were recorded for the future more purely geological work in the islands, the work instituted under the Spanish régime by Abella, Centeno, Santos, Von Drasche, and others, and which will be carried on under American direction and operation.

As stated before, the advent of the rainy season terminated further work in June, and the party returned to Manila. The geologist proceeded overland to the south, through the province of Benguet, for a hasty reconnoissance of the valley of the Agno River, and to examine the mineral districts of Benguet in order to prepare for the field work in the future, when these areas will be taken up. The mountain trails were followed as far as Baguio, the capital of Benguet, and from there on the route was via the new government road to Dagupan, where connection with the railroad is made. At the time of the arrival of the geologist in Dagupan railway communication was broken, due to heavy floods, and a steamer was taken to Manila. The entire trip south was made under extremely hard conditions, the floods and storms attendant upon the rainy season being the prominent opposing factor.

The remainder of the party, under charge of Mr. Goodman, field assistant, took the back trail via Angaqui, Concepcion, and Salcedo to Candon. Boats could not make a landing at that season of the year, neither was it possible, owing to the flooded condition of the coastal-plain rivers, to proceed northward to a possible favorable embarking point. In fact, the return from Cervantes to Candon was attended with the utmost danger and hardships at all stages of the route, and that, in addition to bringing safely through the equipment and collections, a detailed route survey was made is greatly to the credit of that portion of the party. It was able to make its way south to San Fernando, thence via steamer to Dagupan, and from there, railway communication having been restored, to Manila. From San Fernando, while awaiting transportation to Manila, a survey was made via Baon, Naguilan, and Sablan to Baguio, the capital of the province of Benguet, more or less the central point of the mineral district of that province. By the two route surveys described above the two main lines of communication to the coast from the mineral regions have been accurately mapped for the first time. Comment on the future value of these surveys is unnecessary, and they are included in the text.

The foregoing outline gives briefly the actual movements of the party in their general relations to the island of Luzon. Of the difficulties that were met with and overcome nothing can be written that adequately presents the true conditions. Geological work in the Tropics has for its attendant evils, and to a very small extent benefits, certain conditions that nothing but actual experience reveals.

ACKNOWLEDGMENTS.

In the course of the field work the Mining Bureau party had reason to be grateful for much assistance in various ways. An attempt is here made to acknowledge these aids and to express the keenest appreciation of the many courtesies which were extended and which in many cases were far beyond the requirements of the official duties of the several gentlemen named. This appreciation is due to Capt. F. F. Stewart, of the Coast Guard steamer *Masbate*, for much information and for assistance in embarking and disembarking the party and equipment; and to Mr. William A. Reed, governor of Lepanto-Bontoc; Messrs. Kane, supervisor, Moir, fiscal, and Travis, treasurer, of the same province, for their uniform courtesy and assistance. To Señor D. Martin Mills, for his cordial and unfailing hospitality and much information, and to Señor Don Augusto Fuster, administrador de las minas de cobre, Mancayan, for valuable data concerning the past condition of the Mancayan mines. To Messrs. Gaffney and Henry Reeder, who, at the advent of the Mining Bureau party, were the only American miners at that time in the district, the writer is indebted for a great deal of information and aid, most of which, without their guidance, would have been missed. These latter gentlemen gave their services freely as guides in the various explorations, during many days. To Mr. William Woodward thanks are due for the use of a substantial house in the latter part of the survey, in the inclement weather; and lastly, but by no means the least, to the many officials, provincial and local, of the regions through which the party passed, and who in every case gave all the assistance in their power.

CHAPTER II.

HISTORY AND PRODUCTION.

The history of the Spanish mining enterprises, whether in the Philippines, South America, or Mexico, is invariably interesting. The story of the mines of Mancayan offers no exception to this, and in view of the present development of the district it is believed it may be of sufficient importance to be given briefly here.

According to the previous writers,[a] the attention of the thinking public of the Philippines and Spain, and especially of those interested in the mining industry, was for a long time drawn to the northern portion of Luzon as a possible source of mineral wealth, as there appeared, and in some abundance, pots and other implements of pure copper which were said to have come from there. Santos, in his report,[b] says:

"Even in some of the most ancient histories of these islands (Philippines) copper is cited, among other metals, as one of the products which nature affords with considerable abundance, the natives of the mountains utilizing it for arms, ornaments, and in a profitable business. But the most noteworthy document, which claims attention by its official character and its exactness, as later is verified, is the communication to the governor of his excellency the captain-general, D. Pascual Enrile, of the 20th of June, 1833, in which he states that the utensils that the Igorots of the rugged mountain ranges which separate the Province of Cagayan from that of Ilocos make of the copper from the mines have been known for several centuries. * * * With this communication was sent minerals, bars, and spikes of the metal mentioned, which, assayed in the dirección general de minas, gave such good values that not only was it recommended that means be adopted for the exploitation of so much mineral but it gave rise to the creation of the inspection of 1838 and the mining law of 1846."

From such sources as these it became evident that valuable mineral deposits existed, and in 1850 it culminated in the sending of a military expedition into the region to make an investigation, a show of force being essential to Spanish exploration.

With this expedition was sent D. Antonio Hernandez, one of the government engineers, to make an investigation of the deposit, map routes to it, collect specimens, and in general obtain as much information as possible for the public. In this regard it is interesting to note the message of the inspector of mines, Señor Sainz de Baranda. He says:[c]

"I believe it is my sacred duty to give you a very special command. The mines are situated at a place very distant from all centers of population and the inhabitants of the country, if not at war with the Christians, are not by any means subjugated, and of a savage and ferocious character. I charge you, therefore, do not expose your life imprudently, or your health, for not only the examination and the mines but all of them and all the savages of Pangasinan and Ilocos combined are not worth the life of a Spaniard, and least of all of an engineer of your merits and circumstances."

Hernandez left Manila February 3, 1850, and proceeded to Mancayan via the east coast of Luzon to San Fernando, thence overland to the mines, returning about a month later, having spent seventeen days in mountain travel. His description,[d] preceded by the general narrative of the expedition, is as follows:

"Marching from Sugud to the north-northwest to find the valley of the Abra, there is found, after three hours of travel in the territory of Mancayan, in the immediate vicinity of the rancherias of Pacpac and Tavio, a deep glen where runs the Arroyo Tavio or Magamban. This glen is bounded on the north by the mountain Aban, on the south by the Sapit, and on the east by the Tavio, more extensive and elevated than the other two. In the southern side of the first is presented a cut or face of 60 or 70 feet in height and 190 or 200 varas (600 or 650 feet) in length, caused by the landslides which have been produced by past excavations in the middle of the declivity, and the constant action of the atmospheric agents, showing in places a considerable mass of compact quartz with pyrite of iron, whose limits can not be figured, because it is seen to be covered by soil, not presenting apparent stratification, but broken and full of fissures on all the surface; some parts are filled with decomposed quartzose or earthy substances stained generally by oxides of iron or carbonate of copper, and others, although, in lesser number, hung with small crystals, generally of barite.

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[a] Hernandez, Antonio: Reconocimiento de un Criadero de Cobre en el Monte Aban, Termino de Mancayan, 1850. Santos, Jose Maria: Informe sobre las Minas de Cobre de las Rancherias de Mancayan, . . . en el Distrito de Lepanto, . . . Filipinas, 1862. Drasche, R. von: Fragmente zu einer Geologie die Insel Luzon (Philippinen), 1878; etc.

[b] Op. cit. Translated by A. J. Eveland.

[c] Translated by A. J. Eveland.

[d] Translated by H. D. McCaskey, chief of the Mining Bureau.

"The quartz carries in some places gray copper, now intimately disseminated in the mass of the rock in the same manner as is the pyrite of iron, again in small veins from two to three fingers in length, and finally in irregular cavities and in pockets of no great extension. Sometimes the mineral is found compact with the quartz without any appearance of continuity; at others filling more or less completely the crevices of the rocks, leaving several fissures or species of geodes with marked crystallization; and in others finally—and this happens in preference in the masses of larger size—it is found separated from the quartz by well-marked bands of gouge or selvage of a species of fine clay and of great whiteness, although frequently stained by the green carbonate of copper.

"Over the larger concentration of gray copper which is presented to view there has been opened a species of irregular excavation of some 4 varas (13 feet) in depth, and in one of the sides is found a face of the mineral 7 feet in width and 10 in height, terminating in the foreground in selvage and empacked in a tereno summarily weak and decomposed. This being under the surface covered by rocks and fragments of quartz, it is impossible to see where or in what form it is extended; in a like manner the cut of the excavation does not permit of judging as to the extent of the deposit, either in length or depth, seeing only that it continues to the interior of the mountain and to the bottom of the work.

"The mineral pertains to the kind called "tenantite" (tedrahedrite?) or arsenical gray copper, being a sulphide of copper, arsenic, and iron, and containing above 44 per cent of copper, 29 of sulphur, 18 of arsenic, and 9 of iron, and not including the silica, which is found mechanically mixed and therefore in variable quantities. This species, which is that which constitutes the deposit, is found in a mass, somewhat crystallized, and with the crystals there are found, although in small quantities, small portions of pyrite of copper, anhydrous crusts of silica, tablets of barite covered by crystallized quartz, and some pyrite of iron. The matrix is compact quartz with some barite, and many specimens offer the aspect of a breccia of quartz with cement of gray copper.

"The works, which consist only of holes or small caves of few varas in extension, are found scattered over a distance of approximately 180 varas (600 feet). And judging by the considerable quantity of wash which covers the ground to the arroyo, and the cut which is seen in the side of the mountain, attended on the other hand by little present activity of works, it is to be presumed that the exploitation of this deposit dates back to a very ancient period. In the beginning they probably worked on top of the site where they are now working, and by degrees, after having exhausted the mineral immediately under the surface, have gone lower toward the arroyo, thereby precipitating, little by little, through lack of system, a considerable mass of rock, which has removed a large part of the ancient works; nevertheless, there are yet preserved parts of it of greater extent than those which are now worked.

"To open a work the Igorots commence to collect water in a kind of pool or basin which they have formed on top of the declivity, letting it out through one opening, thus causing to fall with considerable violence a mass of water, uncovering the mineral, and indicating the more appropriate places for exploitation. The excavations are executed by means of fire. Placing a little wood fastened to the wall, they ignite it and the following day the mass is found split, which they easily separate from the copper by crushing with stones.

"Although the mass of the deposit is a compact quartz very consistent, it is full of fissures, which makes it necessary to support it, and for this they employ small logs of pine which they place in irregular numbers at the places threatening ruin; notwithstanding this, there is no mine which offers even half a security, and several mishaps caused by cavings have already occurred.

TREATMENT OF THE ORE.

"The mineral after being extracted from the mine is submitted first to a roasting, or, better yet, a crude melting; for this the natives open in the ground a hole one cuarta in diameter by two or three fingers deep, which they cover with some thin sticks forming a gridiron, above which they place a small, compact heap of mineral, held down by a board or piece of tree; and they cover all with thin pine wood, leaving a protected hollow above the board. They ignite this at once, leaving it alone until it has consumed the wood and completely heated the sulphur of the mineral, which takes two or three hours. The products are an impure mass of copper mixed with earthen substances and pieces of coal and scorias of quartz which offer the aspect of a breccia in which the cement has partly disappeared, converting it into a porous mass.

"The copper matte then suffers a melting process for black copper, which they execute in the following manner: They make a hole six or eight fingers in diameter which they surround with stones forming a species of hearth or crucible, leaving an open space for the placing of a pipe connecting with a cylinder bellows. This consists of two cylinders made from a hollowed trunk of pine in which run pistons formed by blocks of wood dressed on their circumferences with dry herbs and chicken feathers, which are held down only by the bellows, so they work in the manner of springs against the interior surface of the cylinders. In the lower part there is a hole and in that they place a cane, closing the valve at the beginning of the stroke.

"Having formed the oven in this manner they charge it with pine fuel, mixed copper, and matte, and put the bellows in motion, taking care to add the fuel in proportion to its consumption, and to agitate little by little with a cane so the copper may fall to the bottom and be cleaned from the foreign substances with which it may be mixed. When they know that the copper has all united into one mass, which should take place after ten or fifteen minutes, they stop the bellows and take out the coal and scorias which overfloat the metallic bath, leaving it uncovered until it has hardened a little and acquired sufficient consistency so that it may be handled. The product is a cake of black copper of rough and broken surface full of earth and pieces of fuel.

"This cake they place at once on a bonfire, where they leave it two or three hours, making it suffer a kind of roasting process, which purifies it somewhat, and they afterwards melt it in the same furnace, placing it in a species of crucible or mold of refractory clay. At the end of this they put the crucible in the hole and over it they place the stone cover and surround it with fuel. They then force a blast, and after the copper is melted they uncover the bath, taking out all the impurities. They remove the crucible from the furnace, and later, when the mass has commenced to consolidate, they compress it with a stick. Finally, they take the cake from the crucible, bury it in ashes until it has cooled, and smooth its surface a little by striking it with a stone.

"The copper obtained in this manner they sell partly in cakes to the Christian people in the lowlands and partly dedicate to the manufacture of pots and boilers, which the Igorots forge with stones; also making of the same metal bars, tongs, and small pipes for smoking.

"There remains now to consider the deposit of copper of Mancayan from an industrial point of view. According to what we have already said, the operations practiced up to date are all very superficial, and we do not believe they authorize the fixing of an opinion with respect to their importance. We are only able to say that the copper deposits pertain to the class of irregular deposits, and that, like the study of the laws which follow the distribution of the mineral, they demand a more mature examination and other methods of observation than the very limited ones which we have been able to make. Interesting above all is the inquiry as to whether the mineral penetrates to the interior of the mountain Aban, and whether the discovered masses in its declivities are only indications of concentrates of greater importance; and we believe that that already discovered is sufficient to justify a determination of this point. For this purpose there could be opened a gallery toward the interior of the mountain, which could follow the direction of some of the masses to-day in exploitation, and afterwards there could be opened other galleries branching from the first in a perpendicular direction.

"Furthermore, this deposit, by reason of its very irregularity, offers itself better to a system of irregular exploitation than to an arranged plan of operations. To undertake this there must first be expenses of some consideration in preparatory work, which, besides their costliness, will have to be of slow execution owing to the hardness of the rock. Nor should there be disregarded the topographical position of the territory of Mancayan, and the primitive state of its inhabitants."

The report of Hernandez seems to have awakened considerable interest in public opinion, and the Government took steps to improve the output and methods of mining, requesting information from the engineer. The latter recommended several small improvements, and, with the caustic comment from his chief that "all the instructions and regulations that could be given are utterly useless as being beyond the knowledge and intelligence of the Igorots, and even beyond that of the persons who have requested that they be communicated to the Igorots," Hernandez's connection with the mines ceased.

From the date of this report (1850) several years elapsed before the copper district was brought before the public. Then, in 1856, Señor T. Balbas y Castro made application for the demarcation of the properties. He presents an agreement[a] made in March, 1865, with—

"The infidels, Tibaldo, gobernadorcillo of the rancheria of Mancayan; Mendoza, principal man of the rancheria of Tubo; Lancungan, principal man of Balili; Bayaque, of Bata; Tambana, of Bulalacao; Paduan, of Talbac; and Bagnaqan, of Pat Pat

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[a] Translated by A. J. Eveland.

(and others), * * * who, of their own free will and accord, without the mediation of either physical or moral compulsion, deception, or fraud, but because they are persuaded of the advantages that are to be attained, after having conference with their subjects, and in conformity with these, they have agreed in abandoning * * * the right they may have to the mountains which form the fissure through which runs the small river of Magamba, which washes the entire deposit of the metal, * * * with the condition that these shall be respected and no work done in the interior of the small caves or mines which each rancheria has in exploitation from time immemorial."

For this concession was paid the sum of 500 pesos (about $200), and the natives were guaranteed employment in the mines at regular fixed rates. This agreement was approved by the Government and a stock company was formed under the leadership of Señor Balbas, which proceeded to open the mines, two pertenencias of 83,000 square meters each, under the Spanish law, being laid out and preliminary work being commenced in the same year.

PRODUCTION.

While but few figures of the production of these workings are available, those at hand may be worthy of record, and are here given:

Before the Cantabro-Filipino Company took hold of these workings, it is estimated[a] that from 1840 to 1855, during fifteen years, 40,250 pounds of copper were produced, in the form of cakes or made up in various ways, per year, or a total of approximately 600,000 pounds of metal, at a value of 26 pesos per pico, amounting to 117,000 pesos.

The year 1860[b] marks the first actual production, and in 1860 and 1861 146,470 arrobas (of 25 pounds) of mineral were produced, the greatest yield being from the crushers—that is, 64,688 arrobas—with an average content of 5 per cent copper; screenings, giving 9 per cent metal, yielded 9,608 arrobas; and the production of the first and second class mineral, containing 29 and 15½ per cent copper, was 2,380 and 29,201 arrobas, respectively. The rest of the mineral consisted of mixed ores, from various localities, to about 2,200 tons in all.

In 1862 145,000 arrobas of mineral were produced, or about 1,800 tons; in 1863, 170,000 arrobas, or about 2,200 tons; in 1864, 180,000 arrobas, or about 2,500 tons; giving a total of 666,470 arrobas up to the end of 1864, or approximately 8,500 tons of mineral.

Further production was, in 1866:

Product.	Copper.	Amount produced.	Content in metal.
	Per cent.	*Pounds.*	*Pounds.*
First class	38	7,650	2,907
Second class	20	288,302	57,072
Various, making a total of	....	2,509,175	234,807

No further figures are available to show the amount of ore produced from these workings. From another place[c] is taken the statement that up to 1874 there were produced by the Cantabro-Filipino Company 2,500,000 pounds of copper as a result of its operations.

In 1875 the efforts of the Cantabro-Filipino Company came to an end and it suspended work. Santos, whom the Spanish Government had loaned to the company for a considerable period of time, died at the mines, and it is supposed that the cessation of the labors of this, their guiding spirit, contributed in no small degree to the reason for the closing down.

The smelter site and the mine openings remained as they were, and the natives and the Chinos for many years reaped a harvest from this ore, smelting and refining the product in a wonderfully skillful manner. Various projects to reopen the mines came to nothing, and finally in 1898 occurred the war with Spain. In the American Army, and especially among the volunteers, which were principally Western regiments, there were many men who had spent long years in prospecting and mining in other regions, and it was not long before the localities in the Philippines reported ore bearing became known; so that it was the most natural thing in the world for those hardy men to penetrate into this and other portions of the islands in search of mineral, even when the country was, to say the least, dangerous, as many a sharp conflict showed.

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[a] Santos: Informe, p. 19.

[b] Obtained, by courtesy of Señor Balbas, from a few of the yearly reports of the Cantabro-Filipino Company.

[c] Centeno: Memoria Geologico Minera de las Islas Filip., 1870, p. 44.

Early in 1900, in January, a party of Americans,[a] eight in number, reached Mancayan, and saw, as they could not fail to do, the rich copper ores of the old mines. Claims were promptly located, and as their knowledge of the district increased, the ground farther south to Suyoc was examined and located. A month later another party came in, to be followed only a few weeks later by another. This made the the district well populated in comparison to its former status, and, according to the Western (United States) customs, a "mining district" was formed and rules drawn up, even though no one knew what mining laws would prevail. For this and other reasons, owing to the unsettled nature of the Islands and its people, but little was done toward exploitation for a year or more. When the laws were promulgated and the attention of those willing and able to help was attracted, development was started in earnest, under the severe conditions which prevail. The future of this and other districts of the Islands will have much to be grateful for—to the courage and skill with which these pioneers (no less so because of a warm climate, and in modern times) forced their way and opened a way for others to follow.

CHAPTER III.

GENERAL.

GEOGRAPHY.

From the index map (Pl. I) it will be seen that the Lepanto copper area of that of Mancayan, the most important district, lies almost directly north of Manila, the barrio of Mancayan being in latitude 16° 53′ north (determined in the field) and approximately the same longitude as Manila. The latitude and longitude of Mount Data, which is only a few miles to the east of Mancayan, is given by the Spanish authors as latitude 16° 57′ and longitude 120° 55′ west; and of Cervantes, the capital of Lepanto Province, from the same sources, latitude 17° 01′ 10″ north and longitude 120° 50′ 30″ east, approximately.

The region as a whole is in the extreme southern end of Lepanto, on the western slope of Data, the latter a noteworty eminence among the lesser peaks of the Cordillera de Solis. Data, the divide between Benguet and Lepanto, and the Malaya Range form a rough basin, in which the Abra River has its origin, and on the western and northern borders of this basin the mineral-bearing ground has been exploited.

To the south lies the northward-reaching angle of Benguet and the valley of the Agno River; on the east, Data separates Lepanto from the Asin Valley; on the west is the Malaya Range, with the valley of the Abra.

The scene of the most active work is centered at the barrios of Mancayan and Suyoc, and in their immediate vicinity. From Cervantes south to Mancayan is by direct line a trfle over 9 miles, the trail with its windings bringing this distance up to between 12 and 13 miles (about 19 kilometers). From Mancayan southeast to Suyoc is a little less than 4 miles (6 kilometers) by air line, the divide between the provinces of Lepanto and Benguet being a mile or so farther south. The exploration and development of the copper and gold deposits have been undertaken several miles south of Suyoc and for a mile or more north of Mancayan, in a belt of varying width—at its widest a mile or two—this giving an area under actual attention of 7 miles in length by 2 in width—14 square miles (35 square kilometers).

There are at present two routes to the district. The northern route, from Candon on the coast, via Salcedo, Concepcion, Teila Pass, Angaqui, and Cervantes, is a horse trail which during the dry season is in good condition. Its difficulties consist of the steep ascent and descent of Teila Pass, and the amount of fording necessary between Salcedo and Concepcion, thirteen crossings of the river being necessary. In the rainy season the muddy condition of the trail from Candon to Salcedo, the flooded condition of the Balidbid River between Salcedo and Concepcion, and the destruction of the trail beyond practically closes this route. Another trail, a few miles to the north, from Angaqui to Santa Maria, is an alternative evil. There is contemplated a new trail from Cervantes directly across the Malaya Range, down the Chico River to Tagudin, which it is believed will relieve the present conditions. This trail will shorten the journey from the coast to Cervantes and it is believed will be available during the rainy season.

The trail to the south, to Baguio, is a good horse trail, but also has the disadvantages of the numerous fords which characterizes all island travel. Baguio may be reached in from three to six days, passing via Bugias, Kabayan, Adoway, Daklan, Ambuklao, and Trinidad, and from Baguio or Trinidad two days more are necessary to reach San Fernando on the coast. At this writing there is completed, or at least open to travel, the new Benguet road—a graded carriage road from Baguio to Dagupan, the northern terminus of the railway.

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[a] If informed correctly, the party consisted of Messrs McCauley, Woodward, McClusky, Harvy, Milton, and Stueber. These were followed by Leonard, Ickard, Michaels, Whitmarsh, and Gaffney—almost without an exception ex-soldiers.

The most available route, therefore, is at present by the northern trail, subject to delays and mishaps in the rainy season.

In the mineral district the main trail from Cervantes, Lepanto, to Benguet passes directly tthrough Mancayan and one-half mile east of Suyoc. Another well-kept trail leads eastward from Mancayan into the basin on the west flank of Data known as Balili, about 3 miles. Apart from these, there are no trails other than those of Igorot construction. These trails—footpaths over which the Igorots trudge contentedly over impossible grades in single file—form connecting links between all barrios, and are found on every ridge; while they give fair communication among the natives, they offer no solution of the transportation problem.

CLIMATE.

No meteorological data are available for the Province of Lepanto alone, but it may be said that, in common with the whole Philippine group, generally only two seasons are recognizable, the wet and the dry. From November to April the climate of Lepanto leaves little to be desired. At this time of year clear weather predominates, only the occasional mountain showers breaking the long dry season.

At the altitude of Mancayan—the highest knoll in the village being little short of 4,000 feet—the temperature is comparatively low, blankets being comfortable if not actually necessary at night, and on the upper slopes of the southern end of the Malaya Range it is affirmed that the vegetation is killed at periods by low temperature. On good authority it is stated that actual frost has occurred. As late as July (in 1904) it is a fact that three natives died of cold and exhaustion while crossing the Malaya Range at about the same altitude as Mancayan. The mean annual temperature (for Manila) is between 26° and 27° C. (approximately 80° F.). These figures are considerably lower in Lepanto. In general, April, May, and June are the hottest months, followed by the steady rains of the period up to October and November, the entire rainy season coming between the months of May and October.

VEGETATION AND TIMBER.

As in all tropical areas, the native vegetation of Lepanto is heavy and luxuriant. The slopes are heavily covered with a growth of tree ferns, canes, grasses, and small brush, and it is only on the top of ridges that clear spaces are met. The grass of the region is a long, tough, and rank-growing variety, which, unless kept down by burning off, is not particularly good for fodder. The various varieties of cane find a multitude of uses—woven in a variety of ways for almost all conceivable purposes and for construction and clothing. Of the canes the true rattan or bejuco is not found to a large extent in this section of Lepanto. These two of the smaller growths are by far the most important, as the intermediate and useful bamboo is, in the area, not found in any but very small amount.

Of timber proper the notable examples are pine and oak. It may be noted that, according to the older residents of the district, at one time the valley of the Abra River and the adjacent slopes supported a heavy growth of pine and narra (*Plerocarpus indicus* Willd.). At present there is hardly a stick of timber in the entire region within a radius of 10 miles of Cervantes. On the lower slopes, near the cultivated land, no timber whatever occurs, and it is only on the more inaccessible portions of the Cordillera del Malaya and the upper portion of Mount Data that anything like good timber exists. The valley is but another instance of the shortsighted policy of destruction of forests when proper care is not taken, and without the slightest doubt the absence of retaining timber over this drainage area has a considerable effect on the run-off and the condition of the rivers in the flood seasons. Much of this timber was consumed by the smelters of the Cantabro-Filipino Company in their operations, and at present a demand for timber would necessitate a 2 or 3 mile haul for a small amount, and if heavy demand were made on the forests for such purposes as fuel a considerably greater distance would have to be reckoned upon. The pine growth is of good sire, clear and straight, up to about 2-foot (diameter) sticks. On certain portions of the higher ridges a moderate oak growth is met. This latter is heavier south of the mineral region, in Benguet Province, but, in necessity, fairly accessible.

AGRICULTURE.

Aside from the timber products, and the natural wild growth common to all tropical regions, Lepanto offers along certain agricultural lines considerable opportunity for development.

In all portions several varieties of the banana are plentiful, serving as a food product. The coffee, especially in the higher regions (above 3,000 feet), is of most excellent quality, and at one time large areas were under cultivation that are now given over to grass. Cacao has been tried and successfully cultivated to a considerable extent. Sugar cane on the lower portions of the area, such as the flat at Comillas, yielded in past times exceptionally good returns; and the staple product, rice, reigns supreme. The labor and care given to this particular crop by the Igorots is something prodigious, in the construction of the paddies alone. Terraces to heights of 1,000 to 1,500 feet are not uncommon, and flumes, sluices, and dams are everywhere in evidence. The bulk of the product that is not consumed on the ground is not shipped out to the coast for export, but, on the contrary, into the interior to less fortunately situated peoples. The entire valley of the Mancayan River, as well as the Abra and its other tributaries, is flanked by rice paddies. No estimate has ever been made of the value of the crop annually, but from the number of hogs, dogs, and other merchandise sold by the traders from the coast, the figures must be of large proportion. The camote (a variety of sweet potato) is even more invariably cultivated, as it is the principal article of food. It grows rapidly, bears throughout the year, and requires but little care, conditions perfectly in accord with the ideas of the Igorot.

The natives—that is, the women and children—are engaged in the cultivation of the rice and other crops. The male Igorot does but little manual labor, the cultivation of the camote patches upon which the family depends for food, the rice fields, and other crops being left to the labors of women and children. The resemblance to the American Indian in this respect is striking, the position of head of the family and the state of proprietorship of any cattle or lands he may possess being evidently sufficiently arduous labor for the Igorot. Apart from the occasional mining and smelting done by him, there is little regular industry. The mining in the wet season, the cultivation of the crops, and the care of cattle are the chief employments.

POPULATION.

Within this district lies the large town of Cervantes, the capital of the province, which is the only considerable gathering of population in a town. Others, such as Mancayan to the south of Cervantes, have but little of a collected population. In the total, the number of inhabitants of the distirct is not inconsiderable, but a view of the country reveals no villages of any size.

The tendency of the Igorot is to collect in groups of at most a score of huts, far up on some almost inaccessible ridge, and to avoid anything like a large village. Within a radius of a mile or two of Cervantes, Mancayan, Suyoc, and Cayan may be encountered numerous small barrios, which bring the population of the province up to 72,750.[a] Cervantes proper has a population of 1,437 civilized, but with its outlying barrios the population, as given in the Gazetteer of the Philippine Islands from the census of 1887, is 16,000.[b]

Similarly in the village of Mancayan are, according to the census of 1903, 118 civilized inhabitants, but its total population is about 1,500. The total population, almost wholly "wild," of Suyoc is 600.

GOVERNMENT.

The present system of government places directly in charge of the province and answering to the civil government of the islands a governor, a supervisor or engineer, a treasurer, and a secretary. These unite as a provincial board and decide as a whole the work to be done. In the various subdivisions are native presidentes (or headmen) and their consejales (or aldermen), and purely local affairs are directed by these, subject to central supervision and command. A group of old men in each smaller village have tacit powers, and it is one of the good points in the Igorot make-up that their word has such great weight.

While it is hardly within the province of this report to enter deeply into racial characteristics, a very few words as to the nature of the inhabitants of these mining districts may not be out of place.

The Igorot is somewhat sharply distinct from the other races of the islands.[c] He is supposed to be derived from the races of the Malay invasion, which were driven inland by the later invasion from the same region. He is a sturdy savage, generally happy and content, of considerable intelligence, and good disposition; from a racial standpoint, moral and honorable. He takes not kindly to labor, not from the inherent mistaken idea of the Tagal, who despises work as degrading, but from the fact that he is of the mountain, free and untrammeled, and much labor is not necessary to his existence. He is more hardy than his brother of the coasts and plains, and as further more inaccessible portions of the island are reached many fine specimens of men and women are seen.

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[a] Of this number 70,283 are classified as "wild" and 2,467 as civilized. Census of the Philippine Islands, 1903.

[b] The census of 1903 gives no total figures for towns and barrios, so that this figure must be accepted, though of doubtful value.

[c] See Virchow, Rud.: The Peopling of the Philippines, 1897; and Jenks, A. E.: The Bontoc Igorot, Volume I of the Ethnological Survey Publications of the Government of the Philippine Islands.

In religion his ideas are crude, and have more or less of an oriental tinge—in fact, a mixture of the Shintoism of Japan with the belief of the North American Indian could not be far from the religion of the Igorot. Crude as the belief may appear to Christians, it is nevertheless a religion, a belief in a spiritual authority. The respect and deference accorded to the old men has been already commented upon; the Igorot feels a moral obligation to care for his aged that is rarely exceeded.

In advancement the Igorot is a curious mingling of the most ancient and the quite modern. The agricultural implements in use are the most primitive of iron instruments, and the pointed stick is in common use. The flint-and-steel method of making fire is used in certain parts of the province, and in others the "fire gun"—a tight-fitting piston in a barrel heating the compressed air—is the means used. In his copper smelting the process used is extraordinarily in accordance with modern practice, and yet in casting objects of gold, bronze, or copper the "cire perdue" process is used, a method which is also practiced by the Burmese bell founders, and which has come down from the Bronze Age. The use of a blast cylinder is common, superseding blowing by mouth, or a bellows; the pan for washing gold is of superior pattern; and the native has progressed far enough in construction to build an arch, though a "false arch," formed by courses of stones projecting inward, one course above another, and not the more advanced type, the "true arch," of the keystone; and yet the Igorot has faith in the trial by ordeal, and reckons the passing of time by the height of the sun, and longer periods by the recurrence of the moon and by the number of harvests.

Chapter IV.

TOPOGRAPHY AND HYDROGRAPHY.

TOPOGRAPHY.

Northern Luzon, above the sixteenth parallel of north latitude, presents fairly uniformly a single topographic type. It is characterized by parallel approximately north-south mountain ranges, with extensive longitudinal valley systems. Broadly speaking, almost in the center of the island is the main chain, the Cordillera Central, and its extensions, the Cordillera del Norte and the Caraballo Sur, which forms the main watershed of Luzon. Two coast ranges, the Sierra Madre of the Pacific coast, and a series of somewhat irregular ranges on the west coast, under a variety of names, mark, with the main mass shown, the roughly parallel system of mountain range and valley. From the central cordillera transversal valleys modify the regularity of the structure and present, in central northern Luzon, a broken and irregular appearance, the region immediately to the east of the Cordillera Central being particularly irregular.

Denudation is the keynote of the topography, and although the immediate east and west boundaries of the area more closely connected with the territory under mining investigation depend to a greater or less extent on the structure, the limiting ranges on the sides being tectonic in type, late volcanic action and extreme degradation have combined to produce topographic forms unclassifiable under one head.

The regions of Mancayan and Suyoc are at the head of the Abra Valley, which has resulted from the breaking down of an anticlinal arch of wide extent, and possibly to some degree to faulting of the same.

On the west of this valley lie the Cordillera del Teila, an escarpment of westward-tilted sedimentaries rising some 4,000 feet above the level of the sea, and here on the east having a precipitous slope to the valley of the Abra (at Angaqui), at the foot of Teila Pass, of 3,000 feet.

On the east the main watershed of the Cordillera Central marks the boundary of the province, and similarly this range is flanked on the east by tilted sedimentaries. The valley is terminated at the south by spurs in a northeasterly direction, which also mark the boundary of Lepanto Province.

The topography of the immediate area of the mineral exploitation is therefore of a limited area only—that of the headwaters of the Abra River. Situated as this district is, on the flank of Mount Data of the Cordillera Central, and closely surrounded by the limiting ranges, the topographic forms are dependent to greater measure upon drainage and subsequent degradation than upon structure. The sedimentaries to the west are some little distance from this region, and those to the east, though uncovered by river action only at the immediate eastern side of the mineral district, have been buried by late volcanic material to a considerable depth. Drainage from this region is directed altogether to the north, ultimately, and the generally northern trend of the valleys in connection with the usual radial type of mountain mass erosion produces the resultant deeply eroded surface.

The small area over which mining and prospecting are being carried on rests on the west slope of Mount Data, and a spur which extends from that mass to the west. As a whole, the slope of Data to the western side is uniform, forming an irregular conical mass, around the base of which runs the Abra River and its tributaries. On account of rainfall conditions the erosion has been marked and steep gorges, V-shaped, are the rule. The upper volcanic rocks of the eastern portion of the region are of a yielding nature, and erosion produces rounded forms, "hogbacks," and mounds, giving a quite regular slope to the immediate base of Data. Further to west, where the rock masses are harder, and in the intermediate areas, where the streams cut through into the hard material beneath, the steep-sloped ravines predominate, and the drainage is divided so carefully that ridges and spurs give at the top but space for a foot trail. Latteral erosion has been deep and rapid, and a general topographic map of a large area will show a well-dissected region.

The towns of Mancayan and Suyoc are situated on the top of the less resistant material spoken of, and the appearance of the area around them, rounded and rolling, is in decided contrast to the steep slopes and rapid fall of the gorges and river channels at their immediate boundaries.

HYDROGRAPHY.

The region of Mancayan, situated as it is on the slopes of Mount Data, is well drained by numerous streams, chief among them being the Abra and its tributaries. The course of the Abra proper is somewhat peculiar. It rises a little south of Mancayan, flowing in a southern direction, for a short distance, describing a semicircular course through well-cut, V-shaped gorges to Comillas, northwest of Mancayan. From there on the course of the river is normal, winding through the broad valley between the Cordilleras de Teila and Solis.

Starting from Tuboc, the barrio nearly in the center of the district, the Mancayan River cuts an almost straight path to its junction with the Abra at Comillas. At a short distance from its origin it is entered on the east by the shorter stream known as the Mangambang, or Tabio, which rises on the Aban spur of Mount Data, and cuts the gorge of some 500 feet through the deposits of copper at Mancayan. Farther to the east, on the upper slopes of Mount Data, the river early develops power, and flowing westward for 1 or 2 miles turns abruptly to the north at a right angle, and finally debouches into the Mancayan at Baguis, 3 miles above (south of) Comillas.

The River Maanse has its origin south of the Mangambang, or Tabio, on the same spur (Mount Aban), flows west to Tuboc, thence south to Cayan, where it is met by the gullies draining the northern side of Suyoc Hill, and then in a westerly direction pursues a winding course through steep, V-shaped gorges to the Abra, several miles southwest of Suyoc.

The topography and geology of the region have affected the drainage to a considerable extent, as will be spoken of later. The rivers north of Mancayan present the usual condition of mountain-river type—the torrential water course, heavy falls, a swift, deep-gorge-cutting stream debouching into the broad valley below. But south of Mancayan irregularities of drainage are met with that indicate certain orographic changes and influences due to the nature of the rock masses.

All the rivers of the region could be described as in first and second stages of development, with steep declivities. They are to considerable extent dependent upon the seasonal changes for their volume and show large variation between extremes. During the dry season, only the springs and the "old" water keep up the volume. There is a very great diminishment in volume and power, though the streams do not by any means run dry. From the beginning of the rainy season the river steadily increases in size, and becomes, after the occasional, long, steady torrents of rain, tremendous confined floods. Until the water reaches Comillas there is, in the case of the upper valley of the Abra, no chance for expansion over any considerable area, and in consequence the rapidity and power of these streams is something astounding. Streams which were but knee-deep and a few feet in width become torrents that a horse can not ford. Under these conditions erosion has been rapid and has its effect in the topographic form.

The Abra River waters above Suyoc and those of the Bat-Bat River to the east are hardly potable from the viewpoint of the European, while the streams heading up in the mineral region, as the Maanse, Pacat, Mancayan, are extremely bad. A great amount of copper and iron salts is present, as well as arsenical soluble salts, and certain springs are quite poisonous. At the meeting of the Mancayan River, which is very clear, and the Mangambang River, slightly milky and brownish, there is deposited a vivid blue film or coating in the bed, which diminishes in intensity for fully 2,000 feet downstream, and the vivid blue color of the water and of the blue-coated bed produced by the chemical reaction is plainly discernible from the tops of the surrounding ridges. The explanation of this unusually strong reaction lies in the fact that the Mangambang River, as heretofore stated, cuts directly through the deposit of the copper minerals of the old mines, and the Upper Mancayan River drains an area more or less shattered and decomposed, with a great deal of altering iron sulphides.

The occurrence is so striking that in previous times it certainly should have been and probably was an index finger to the prospector.

There are, however, many springs among the extraordinary number with which the district is watered, a number of which give cool, clear, and pure (no analysis made) water. These waters are fairly potable.

Hot springs, while not flowing in the immediate area under consideration, are prevalent all through this mountain region. In the province of Benguet, some 40 miles to the southwest, there are numerous active springs, which are sufficiently large in volume and temperature to be worthy of considerable attention. And in Lepanto Province, to the north of Mancayan, there exists a similar region. The nearest of these occurrences is at Comillas, less than 10 miles northwest of Mancayan on the trail to Cervantes, where the trail crosses the River Abra. Here there is a small hot spring which has been described by Centeno, under the Spanish régime, as a ferruginous sodium-chloride spring.

At Cervantes, in the flood plain of the River Abra, by which it is covered at periods of high water, are several springs, or, in all probability, several vents of the same spring, within a comparatively few feet of one another.

On these springs, as well as many others of the islands, the Spanish Government made more or less extensive reports, and the following excerpts are chosen from the reports mentioned, as of some value. Of the Comillas springs, Centeno[a] says:

> "It gushes out of an ancient wash of angular dioritic and other eruptive rocks, forming a small pool at the river, in which, notwithstanding the high temperature, which the human body hardly can bear, the Igorots are accustomed to bathe, with good results in the great variety of cutaneous diseases to which they are subject. From this comes the great faith in their waters, that these poor people have. Guided as they are by superstition in almost every act of their lives, they never bathe here without invoking the favor of the 'anitos' of the spring, making a modest offering, which generally consists of a little 'palay' or rice, which they throw into the pool."

Centeno gives the height of this spring as 460 meters (1,518 feet) above sea level; from the recent survey it is approximately 1,400 feet. A flow of 1.43 liters per second was recorded, or 123 cubic meters in twenty-four hours. The water is clear, transparent, inodorous, and tastes salty; neutral reaction on litmus; no gaseous emanations; temperature of the water, 50° C. (the air, 26° C., December 17, 1886); density at 0° C and 760 millimeters is 1.004375.

Analysis of 1 liter of the water is as follows:

Content.	Weight.	Content.	Weight.
	Gram.		*Gram.*
CO_2	0.060000	CaO (in the decanted liquid)	0.086016
Ca_2O (precipitated by boiling)	.006720	Na_2O	.268349
Mg_2O (precipitated by boiling)	.006882	LiO	Trace.
FeO (ferroso) (precipitated by boiling)	Trace.	So_3	.132532
SiO_2	.074400	Cl	.316655
FeO (in the decanted liquid)	.180000		

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[a] Memoria Descriptiva de los Manantiales de la Isla de Luzon. D. José Centeno (et al.), Madrid, 1890.

Residue obtained by the direct evaporation of 1 liter of water and dried at 180° C. (approximately) weighed 0.851000 gram. It is calculated from the analysis that 1 liter of water at 50° C. contains in solution:

Content.		Weight.	Content.	Weight.
	Cubic centimeters.	*Gram.*		*Grams.*
O	3.965000	0.005669	$FeSO_4$	0.018339
N	7.930000	.009961	NaCl	.506678
CO_2 (free)	17.556375	.034669	LiCl	Trace.
$CaCo_3$		.017280	FeCl	.016427
$MgCo_3$		.021653	SiO_2	.074400
$FeCO_3$		Trace.		
$CaSO_4$		.208896	Total	.913972

The Cervantes spring issues from the margin of the river, at a height (Centeno) of 435 meters above sea level, at a rate of 0.24 liter per second.

The water is clear, transparent, uncolored, inodorous, with a slightly salty, hard taste. It gives out bubbles of gas, and the litmus paper shows a neutral reaction. The temperature of the water is 56° C. (air, 25° C.) and density at 0° C. and 760 millimeters is 1.004732.

Anhydrous substances in 1 liter of the water are as below:

Content.	Weight.	Content.	Weight.
	Gram.		*Gram.*
Co_2	0.004000	So_3	0.521888
SiO_2	.032000	Cl	.335456
CaO	.237440	Al_2O_3	Trace.
MgO	.005125	$CaCo_3$	Trace.
Na_2O	.426687	Organic matter	Trace.

Residue obtained by evaporation of 1 liter=1.483000 grams.

Resulting from the analysis, it is computed that 1 liter of this water at 50° C. contains in solution:

Content.		Weight.	Content.	Weight.
	Cubic centimeters.	*Gram.*		*Gram.*
Co_2	2.025598	0.004000	$CaCO_3$	Trace.
Air	10.689488	.013828	SiO_2	0.032000
$CaSo_4$		.576640	Al_2O_3	Trace.
Na_2SO_4		.324147	Organic matter	Trace.
NaCl		.538121		
MgCl		.012000	Total	1.500736

Both these springs, it is claimed, have a decided medical value, and are largely used by the natives both for bathing and drinking purposes.

At Angaqui are other springs of a sulphurous nature, and in the eastern portion of the province are also many saline and hot springs, all of which constitute a feature of this and much of the rest of the island of Luzon.

CHAPTER V.

GENERAL GEOLOGY.

LOCAL AND STRUCTURAL.

The geology of the limited area in which ore deposits are found is dependent, similarly to the topography, to a considerable extent on the general conditions of northern Luzon. Up to date but little has been known of the geologic conditions north of the central plain of Luzon, and, aside from disconnected notes made by occasional visiting geologists, the geology of the entire northern part of Luzon was mere conjecture. The Spanish authorities made an occasional visit to certain localities, one of which (Hernandez's inspection of the Lepanto area) has already been noted,[a] and, noteworthy among the others, Mr. R. von Drasche visited this area in 1875 and gave to the public his observations. Before these observations and deductions of Von Drasche, rapidly made but showing a thoroughly trained mind, the views as to the constitution of this part of the island were quite at a loss for some facts to tie to. Semper[a] speaks of the "trachytic core" of the island, and the adjacent and overlying sedimentary strata of recent age. J. Roth,[b] a short time later, compiling the information available at that time, states that "on a formation of crystalline schists" lie the Tertiary strata. Roth's conclusions were drawn from the observed occurrence of schists in the islands of Cebu, Leyte, Mindanao, and in the Camarines Provinces of southern Luzon, and also the occurrences noted by Itier[c] of stream pebbles at Angat, in Bulacan Province.

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[a] See pp. 692–694.

Mr. Becker in this report,[d] which gives us the most complete and concise statement of all known information, draws the inference that the crystalline schists are predominant in the basal mass of the islands; and reasoning from analogous conditions in Borneo, and the observed facts of the known occurrences of ore deposits associated with schists or crystalline massives, he so summarizes the previous observations.

From the slight amount of work already done it seems probable that the schists do not occupy as important a place as taken for granted by Mr. Becker, but that, as Abella generalizes,[e] the diorites and dioritic rocks in general are the oldest rocks, at least north of the great plain of Luzon. As far north as the province of Abra, my observations have borne this out, and in this region, west of the Cordillera Central, no schists have been observed.

From the west coast of Luzon, particularly at Candon, the point on the coast at which the party disembarked, to the Cordillera Central, at the mass of Mount Data, the general relations of the rocks are as seen by a reference to the ideal section.[f] The sedimentaries outcrop a mile or so east of Candon, at that locality dipping 40° northeast; between Candon and Concepcion gentle folding has taken place, and the valley of the Balidbid River exposes recurrent anticlines and synclines, the region bearing a striking resemblance to the Potomac River valley and others of like type in the Piedmont area in Pennsylvania, Maryland, and Virginia.

At Concepcion, which is situated in a flanking valley at the foot of the west slope of the range, the tilted sedimentaries are a prominent feature of the landscape. Great jagged blocks are tilted up against the main mass of this range, giving the slope a peculiar flat and geometrical effect.

At the crest of the Cordillera del Teila, as the coast range at this point is called, appears a great thickness of limestone, dipping to the southwest, and below it a heavy, thick conglomerate, cropping on the eastern scarp. The upper limestone, of a thickness of hundreds of feet, forms the crest of the range for an unknown distance; no fossils were collected during the hasty march, but in all probability search will reveal some organic remains; Santos quotes Semper as authority for the determination of nummulites from these beds, in abundance, and for the statement that the nummulites "have up to now occurred in the Eocene ('paleo thérico de M. Cordier') or in the immediately adjacent Upper Cretaceous." Becker[g] cautions the geological observer from inferring an upheaval from inclined stratification, but on account of the adjacent conglomerate and slates it is fairly certain that the tilting of the limestone may be traced to structural causes and that the question of coral growth and pseudo-stratification does not enter here.

The basal conglomerate is also of great thickness, and, while on stratigraphical grounds it may not as yet be correlated accurately, it would appear from the continuity of these sedimentaries, observed from occasional peaks in going to the south through Benguet, and on lithological grounds, that these are the extension of the "Agno beds" of Von Drasche. In the Agno River they are described by Von Drasche as consisting in the lower portions of coarse breccias and conglomerate of dioritic rocks, very coarsely bedded, with pebbles often of enormous size.

Regarding the ages of these rocks nothing can be said, except the deductions already made by others. In the present work economic problems were of the first importance and these sedimentaries apparently have no specific connection with the ore deposits of

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[a] Die Philippinen und ihre Bewohner. 1869.

[b] Constitucion Geologica de Filipinas.

[c] Bull. Soc. Geog., Paris, 3d series, Vol. V, 1845.

[d] Geology of the Philippine Islands, 1901, U. S. Geological Survey, Twenty-first Ann. Report.

[e] Apuntos fisicos y geologicos. 1884.

[f] Plate XXIII.

[g] Op. cit., p. 561.

Lepanto. Von Drasche[a] first classed them as primitive, then Paleozoic. Later Abella seems to have obtained fossils in the upper strata of shells of surviving species and lignite, and adopts the hypothesis that these Agno beds represent the basal conglomerate formed during the Miocene subsidence of the Philippine group.

Mr. Becker remarks, in this connection, that "it is tempting to seek in them (the Agno beds) the equivalent of Mr. Verbeek's breccia stage of the Eocene, which consist of unfossiliferous strata underlying Stage α; but the absence in the region of Benguet of the Cebuan lignitic series and the character of the organic remains appear to indicate that this portion of Luzon was above water during Eocene time." It may be possible that the tentative suggestion of this correlation may be later worked out, as it has happened that lately a small seam of lignite has been discovered on the Benguet road in this region. As it was not seen, its relations to the Agno beds are not known, and the coming field season in this area may throw some light on the subject.

The valley of the Abra River is cut, from these sedimentaries on the west to the Cordillera Central, in igneous rocks of various composition. With the exception of an olivine basalt (?) noted near Cervantes, no general lines were followed until the Mancayan district was reached.

Here, after study of the area, the structure reveals an underlying diorite, the occurrence of which again confirms Abella's deductions.

Various igneous intrusions have taken place in the basal diorite, one of the most noteworthy having a considerable expanse immediately west of Mancayan, the Mancayan River roughly following the contact between the two for a mile or more. This mass seems to have no relation to the economic aspect of the region, and except for a description of the rock (called the Bagan granite, from its occurrence on the mountain of that name), will not be noted further. Other intrusions, and especially a mass at Suyoc, seem to have some bearing on the ore deposits and will be taken up. Except for the more important rocks of those having a direct bearing on the economic problem of this district, geological work on the rocks of this region will be reserved until suitable mapping may be done.

One of the most important masses, however, is the "trachyte" of Santos and Von Drasche, which predominate to the east of Mancayan. The basal diorite, named the "Mancayan" diorite, from its best exposures in the river of that name, is overlain to a variable depth by a crystalline neovolcanic rock, classified, as stated, as sanidine-trachyte by Von Drasche, and by Santos expressed as "porfido arcilloso;" this Mr. Becker translates at argillaceous porphyry, and interprets as a quartzless, partially decomposed lava. This igneous rock outcrops on the west side of the hill on which is situated the town of Mancayan, and the contact follows a north-south approximation through Suyoc into Benguet. The same rock was observed at the town of Daklan, in Benguet, over 30 miles south, and is evidently some extensive lava flow of late age. Facies of this occurrence were observed on the western slopes of Mount Data, and from the topography and structure of the region it is thought that the source of the outburst should lie to the east. Mount Data has been alluded to generally as an extinct volcano, and mention is made of a crater lake at its summit by Meyer.[b] He states that he ascended Data (in 1882), measured its height by barometer as 2,245 meters, and found a lake 1,100 yards in diameter on a bench on the eastern slope of the highest part of the mountain.

None of those who have given to the public notes on this region have made mention of sedimentaries on the west slope of Data. These clays and limestones were observed in a river cutting the base of Mount Data, dipping about 20° to the east. Over the upturned edges of these rocks, which have a section of some 500 or 600 feet exposed by waterfalls, spreads the "trachyte" of Von Drasche, and the upper portion of the mountain is, as far as is known, of the same material.

Judging from the structure, therefore, it is at least open to doubt if the mass of Data, as generally supposed, is the remains of an extinct volcano, or whether Data is the residual mass left by erosion of the eastern limb of the broken anticlinal arch added to by later volcanic action, either intrusive or effusive. It is certain, however, that limestones and a small seam of coal do outcrop on the eastern flank of Data, and that at Cayan, or its vicinity, east of Cervantes, the limestone is again met with, these limestones containing numerous forminifera (nummulites), according to Semper.[c] If Data is of volcanic autogenesis, the activity was probably of a laccolithic type, intrusive, and not of the general mountain-building type prevalent generally in the islands.

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[a] I again have to thank Mr. Becker for his valuable résumé of past explorers; from his report is taken most of the following.

[b] Weltreise, 1890, pp. 253-287.

[c] That is, if Santos has quoted correctly.

ROCKS.

The massive igneous rocks of this locality are represented by diorite, granite, quartz porphyry, trachyte, and one or more varieties of igneous intrusions that are not described. It is unfortunate that many rock analyses and determinations could not be obtained in time to be of service as data for this report, and also that in spite of every effort it was found impossible to prepare thin sections of one of the most important rocks in the district, the "trachyte" of Von Drasche. Due to the decomposed nature of this mass and the somewhat limited mechanical facilities at service, no satisfactory section of this rock is ready, and the additional lack of analyses prevents more than a megascopic description of it.

THE MANCAYAN DIORITE.

The diorite of this locality, the "Mancayan" diorite, is, on megascopic inspection, a dark-green granular rock, coming well under the field classificatory[a] name of diorite. Within the Lepanto area it is uniform in texture and structure, showing unusually little of the variability of dioritic types. As noted before, the same type is noted in Benguet and other areas, and there are good grounds for believing that the diorite is a widely extended mass.

The relative size of the hornblende and feldspar give the rock its color, and in a hand specimen the amphibole is apparently predominant. On weathered surfaces, however, the feldspar stands out in light-colored lath or rod-shaped crystals, within a matrix of the amphibole. No other minerals are noted, megascopically.

In the examination of the thin sections there is revealed a plagioclase, in rod or lath shaped crystals, involved in a matrix of green hornblende. The plagioclase, as seen on symmetrically cut twins, is apparently labradorite, evidently of earlier formation than the hornblende. This reversal of the normal order of crystallization produces the pseudo-ophitic structure noted. The feldspar is white, cloudy, with dull, earthy luster; no zonary banding observed in the limited sections and no kaolinization to a great extent.

The next important mineral, the hornblende, occurs in flakes and very fragmentary masses surrounding the feldspar lathes; light green in the section and has a low extinction angle which can not be exactly determined, owing to the fragmentary nature of the mineral. No uralitization was noted, though the transposition of gabbros or diabases to this diorite may not be positively denied.

No quartz present, nor mica. Olivine occurs in rounded grains in the hornblende, showing slight alteration. Magnetite also noted, in typical forms.

Four analyses[b] of the Mancayan diorite follow:

	No. 1.	No. 2.	No. 3.	No. 4.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Moisture, 110°	0.50	0.28	0.38	0.12
Loss on ignition	2.74	1.38	.70	2.26
SiO_2	50.67	51	47.98	47.94
Al_2O_3	21.21	18.01	18.94	21.96
Fe_2O_3	11.31	.23	7.08	2.48
FeO	.21	9.31	3.98	3.42
CaO	6.86	8.89	11.01	12.63
MgO	4.10	6.53	7.06	6.83
K_2O	.10	.46	.44	.19
Na_2O	1.41	4.42	2.56	1.49
Total	99.11	100.51	100.13	99.35

Local variations may possibly explain variation in these analyses, in the instances of the lime and ferric-oxide content. The lime appears rather above the normal for this type of rock, as are the alumina and magnesia to a lesser degree. The remaining constituents appear about normal.

THE BAGAN GRANITE.

This intrusive mass, the contact of which with the Mancayan diorite is followed by the Mancayan River, west of the town of the same name, is a light-colored, medium, and evenly grained rock, seen by megascopic inspection to consist of quartz, orthoclase, and hornblende. It is evidently holocrystalline, and typically granitoid in texture, coming under a "granite" in a field classification of phanerites. At its contact with the Mancayan diorite, sharp and clearly defined, from inter fingering of the two masses, most of the places seen indicate that the granite is later than and intruded into the older diorite. Alteration or metamorphic action has taken place only to a very limited extent, and in many instances sharp angular "horses" of the diorite are included in the granite, near the contact, with no change whatever.

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[a] Cross, Pirsson, Iddings, Washington: A Quantitative Chemico-Mineralogical Classification and Nomenclature of Igneous Rocks. Chicago, 1902.

[b] Analyses by Mr. L. S. Salinger, Bureau of Government Laboratories, Manila, P. I., 1905.

Under the microscope this rock is readily classified as a hornblende granite, showing quartz, feldspar, and hornblende only in the slides examined.

The quartz is typical of similar occurrences elsewhere—xenomorphic colorless grains and masses, glassy in its pelucidity and clearness, with numerous dust particles and gaseous inclusions.

Both soda and lime feldspars occur, with orthoclase predominant, in simple crystals, and numerous twins. Little of the feldspar is fresh, and it shows the typical decomposition structure, with well-marked cleavage planes and pearly luster.

The hornblende is also normal. Irregular masses, showing prismatic cleavage; the ordinary green variety is predominant, and occurrence of glaucophane (?) is noted. Other facies of the same rock give the more common brown of the hornblende, and in these some slightly more idiomorphic forms are noted.

Magnetite and possibly other iron minerals occur in abundant groups of crystals. There are also small inclusions, indeterminate, of a highly refractive mineral, which suggest possible titanite. Apatite occurs in small amounts.

Analyses [a] of this rock follow:

	No. 1.	No. 2.	No. 3.
	Per cent.	*Per cent.*	*Per cent.*
Moisture	0.02	0.13	0.20
Loss on ignition	.39	.84	1.01
Silica (SiO_2)	77.21	73.56	71.80
Alumina (Al_2O_3)	15.38	1.42	2.46
Ferric oxide (Fe_2O_3	.72	1.27	1.93
Ferrous oxide (FeO)	.93	14.30	14.28
Lime (CaO)	2.18	2.50	2.96
Magnesia (MgO)	.42	.79	.22
Potassium oxide (K_2O)	.50	.38	1.54
Sodium oxide (Na_2O)	2.26	5.09	3.02
Total	100.01	100.28	99.42

THE QUARTZ PORPHYRY.

This rock, the mass characterized by Santos [b] as "porfido argilloso," or argillaceous porphyry, as Becker translates it, occurs on the western side of the Mancayan hill, resting on the Mancayan diorite beneath. This one outcrop extends a distance of several miles, disappearing north and south under the "trachyte" which covers it at Mancayan. There are to the north several smaller outcrops, isolated masses or islands, and the whole mass has been the subject of considerable conjecture and limited study, having, as it does, a direct bearing on the ore deposits of the copper region.

Santos [c] describes it as "a quartzose mass in a vertical position, not more than 80 or 100 meters in thickness, which strikes northwest, and is exposed at the southeast by a great cut, partly due to the mining operations of the natives. Toward the northwest it is partially concealed and disappears under argillaceous porphyry (porfido argilloso), which is more recent. The siliceous mass is of the same character throughout its extent; it is sometimes compact, sometimes crystalline, often porous, and always charged with iron pyrite. It contains decomposed feldspar in irregular veins, or porphyritically disposed. The croppings are of columnar form. The whole mass is fissured or jointed in different directions." Mr. von Drasche later visited this locality, but could not discover the rock relations. He speaks [d] of the rock as a rhyolitic quartz-trachyte, which shows flow structure, with variations in the color of the groundmass from dark gray to red. In this thick, hard, splintery ground mass are quartz fragments, extremely numerous. They are never rounded nor do they show other than a regular character; they attain a thickness of 4 millimeters. Thin sections gave him no clew to the nature of the ground mass, but he states that it is evident that the quartz fragments have not come from the ground mass and that they were "wrapped up" by the still fluid magma.

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[a] Bureau of government laboratories.

[b] Op. cit.

[c] Informe sobre las minas de cobre, p. 25.

[d] Von Darsche, Fragmente, p. 37.

The two descriptions already given cover fairly well the general aspect of this rock—it is a hard, flinty, red to yellow-white quartz leucophyre with prominent quartz phenocrysts. Nothing can be made of this ground mass with the naked eye, and the study of the thin section reveals little but that it is extremely siliceous. The quartz seems to be perfectly clear and often perfect in crystalline form, and the doubly terminated hexahedron predominates. There is little or no superficial weathering of the rock mass, though the entire rock shows great alteration, and is without doubt a product of metamorphic processes. Under the microscope the porphyritic nature of the rock is more clearly visible—whole and fractured quartzes set in a quartz-feldspar paste from which little can be determined. Spaces of dissolution are a prominent feature of the rock, occasionally giving a cellular structure, and the presence of pyrite and magnetite is everywhere noteworthy.

From the few sections at hand, none of which proved to be entirely satisfactory, little positive information could be gathered. It does not appear, however, that Mr. Santos's conception of the mass can be regarded as correct; careful search was made for the columnar structure he noted, but beyond a series of cross fractures which form a noticeable characteristic of the exposure, it is certain that he must have been misled. Similarly, there is not the slightest hint of sedimentary origin in any of the exposures or thin sections examined.

Mr. von Drasche's necessarily hasty observations, leading to the view that this mass is a lens of quartz embedded in the trachyte, are not substantiated by a more careful study of the structure of the region, and hence this view is regarded as improbable.

All the evidence at hand points to a contact zone of limited extent, produced by the Mancayan diorite being covered by a considerable flow of the "trachyte." Both microscopic and megascopic evidence show that the quartz porphyry is not original as such, and that but little of it, except the quartz, has existed unchanged since its formation.

Three analyses [a] of the quartz porphyry are given below:

	No. 1.	No. 2.	No. 3.
	Per cent.	*Per cent.*	*Per cent.*
Moisture	0.22	0.11	0.00
Loss on ignition	1.24	2.70	3.18
Silica (SiO_2)	89.49	90.60	87.96
Alumina (Al_2O_3)	4.88	.07	3.75
Ferric oxide (Fe_2O_3)	4.24	3.15	3.89
Ferrous oxide (FeO)	.05	1.15	.69
Lime (CaO)	.04	.08	.08
Magnesia (MgO)	.32	.58	.23
Potassium oxide (K_2O)	.08	.16	.11
Sodium oxide (Na_2O)	.25	.70	.39
Total	100.81	99.30	100.28

THE TRACHYTE.

Covering all to the eastward of a line from Mancayan to Suyoc, and apparently over a much greater general area, is a rock which Von Drasche classifies as a hornblende-sanidine-quartz-trachyte, and from lack of other than megascopic inspection for a guide, that name, or more simply quartz-trachyte, expresses the rock as nearly as may be.

It is a much-decomposed granular-to-porphyritic mass, which weathers to varicolored clay, giving an appearance to the soil which may not be mistaken. In all the field work no absolutely fresh specimen could be obtained and those collected have altered in the laboratory.

There is present a noticeable amount of quartz in clear, rounded, fracture grains and prominently in doubly terminated hexahedrons; feldspar in short, tabular crystals, much decomposed; clear sanidines with typical luster and twinning; a ferro-magnesian mineral, indeterminate as to amphibole or pyroxene, in somewhat noteworthy amount; occasional biotite; considerable magnetite. The placing of the feldspars in the general mass gives the typical orthophyric structure, as opposed to the more common trachytic structure; the proportion of ground mass varies locally, but in all cases it is subordinate to the phenocrysts, approaching a pronounced granitoid texture in cases.

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[a] Analyses by L. A. Salinger, bureau of government laboratories, Manila.

Below are given several analyses[a] of the rock, made from imperfect field specimens. With no microscopic examination possible, and only the aid which the divergent and not representative analyses give, it appears that more exact determination may better be left to more detailed work in the Mancayan region. The name given by Von Drasche appears to be sufficiently definite for the purposes of this report and the rock will be so designated.

Analyses.

	No. 1.	No. 1.	No. 3.
	Per cent.	*Per cent.*	*Per cent.*
Moisture	1.58	1.84	3.83
Loss on ignition	4.82	7.04	2.23
Silica (SiO_2)	54.80	68.31	60.48
Alumina (Al_2O_3)	19.29	18.18	18.11
Ferric oxide (Fe_2O_3)	1.83	2.15	3.14
Ferrous oxide (FeO)	2.54	.37	1.67
Lime (CaO)	8.21	.24	4.94
Magnesia (MgO)	3.11	.25	2.12
Potassium oxide (K_2O)	2.50	.98	1.38
Sodium oxide (Na_2O)	1.55	None.	2.40
Total	100.23	99.36	100.30

CHAPTER VI.

ORE DEPOSITS.

MINERALOGY OF THE ORES—GANGUE MINERALS.

Under the head of gangue minerals are included those most intimately connected with the metallic minerals of the lodes, and which form the matrix of the latter. The term is used in its commonest sense, to signify the constituents of the lode that occur in intimate connection with the mineral under exploitation, and as the ores of this district are of a prevailing type, no ambiguity will result.

Quartz.—Comp. SiO_2, oxide of silicon = oxygen 53.5, silicon 46.7 = 100. Massive or in hexagonal prisms terminated by rhombohedrons. Often in double six-sided pyramids. Generally white or colorless. Hardness = 7. Sp. gr., 26. Luster, vitreous, sometimes greasy. Transparent to opaque.

The quartz of this region shows essentially the same characteristics of vein quartz that occurs in most mining districts. There is present a comb-structure quartz showing "crustification," or banded-vein structure, having its origin in the filling of fissures either by growth in an open space or by slow expansion of a mere crack. The quartz of the Mancayan mines is hard, tough, compact, of a resinous luster, much shattered, and of a fine grain. The quartz from this locality is, from its observed nature, due almost entirely to secondary action of silicifying solutions. Replacement of other minerals and the filling of rock fractures have produced a quartzose mass, the bulk analyses of which shows a high per cent of silica. Such rock in thin sections under the microscope may reveal skeleton-like forms of crystals of other minerals, replaced entirely or partially by silica.

Almost without exception the vein-filling material of the region is quartz, the proportions of other minerals present being variable. There are, besides, occurrences of minerals other than quartz in that capacity which may be spoken of.

Barite.—Barytes. Comp. $BaSO_4$, barium sulphate, orthorhombic, commonly in tabular crystals, in divergent form, or massive. From its high specific gravity (4.5) it takes the name "heavy spar." Cleavage perfect in three directions. White. Transparent to opaque. Sometimes yellow, gray, brown, or red. Barite is less important as a vein material in this region, but its occurrence is noted.

Calcite.—Calc spar. Comp. $CaCO_3$, calcium carbonate=carbon dioxide 44, lime 56=100. Rhombohedral. Cleaves perfectly in three directions, producing rohmbohedrons. Commonly in this form, or prisms, scalenohedrons, or massive. Color variable, where impure, generally white or colorless. Transparent to opaque.

Unimportant as a vein material, though occurring throughout the district. Found in abundance as a microscopic constituent of lode materials.

Kaolinite.—Kaolin. Comp. $H_4Al_2Si_2O_9$ or 2 H_2O. Al_2O_3. 2 SiO_2=silica 46.5, alumina 39.5, water 14=100. Monoclinic. In scales or plates, and generally in fine white powder. Occurs as clay-like masses, compact, mealy, or friable. H.=2–2.5. Sp. gr., 2.6.

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[a] Analyses by L. A. Salinger, bureau of government laboratories, Manila.

This mineral occurs throughout the district, and especially in the Suyoc region, as a result of the decomposition of rock material, aluminous minerals, and feldspars. At Mancayan veins of several inches in thickness run through the upper trachyte; these are very pure kaolin, of a good white color. They crop out south of the village on the main trail.

Gypsum.—Comp. $CaSO_4$, 2 H_2O, hydrous calcium sulphate=sulphur trioxide 46.6, lime 32.5, water 20.9=100. Monoclinic, varieties selenite in transparent tabular crystals, to massive, often fibrous, cleavage on one plane eminent, giving foliated structure. H.=1.5–2. Sp. gr., 2.3. Luster, subvitreous to shiny. Color usually white; varieties, where impure, colored. Transparent to opaque. The occurrence of gypsum at Suyoc is suggestive of recent volcanic activity. In the gorges of the Pacat Rivers and other drainage streams of Suyoc hill occur numerous veins of gypsum, often of considerable extent. These veins are of the fibrous variety, the widest observed giving a length of about 2 or 3 feet to the curved transverse fibers. Some of the rich values of that particular region were, it is claimed, taken from one of these veinlets.

ORE MINERALS.

This heading embraces the minerals of this district, which are generally mined for ores, or value of some nature, although it may be borne in mind that local conditions determine to a great extent just the heading that certain minerals come under. The minerals of this list, unless attention is called to it, have all a metallic luster.

Gold.—Comp. gold. Isometric, but rarely showing crystalline form. Usually in irregular particles, filiform dendritic shapes, "wire" gold. Thin plates, rounded edges, and flattentd grain or scales. Cleavage none. Fracture hackly. Very malleable and ductile. H.=2.5–3. Sp. gr., 15.6–19.3, 19.33 when pure. Luster, metallic. Opaque in ordinary masses.

In the Lepanto mining districts most of the attention has been directed to the free-gold workings.

At Suyoc, where visible gold is to be observed, the metal occurs in fine plates and grains in small quartz seams, in connection with sulphides of copper, zinc, and lead. The natives work only the free gold and have no knowledge of other values. Farther north the gold values seem to be more closely confined to iron pyrites, and less to the other sulphides. In Mancayan gold values are obtained from both the copper ores of the district and the quartzose vein matter of Mancayan and Tuboc.

Pyrite and marcasite.—Pyrites, "iron" pyrite, "white" iron. Comp. FeS_2, iron disulphide=sulphur 53.4, iron 46.6=100. Isometric, pyritohedral, cube and pyritohedron (pentagonal dodecahedron), octahedron, or combination of these, the common forms, sometimes striated Frequently massive, and finely granular. Color, pale brass yellow to whitish. Luster metallic. Opaque. H.=6. Sp. gr., 5. The common sulphide of iron here, as generally in mining districts, is common in all of the ores of the region, and to a greater or less extent present in the rock masses in the vicinity of the ore deposits. In this region the pyrites occur alone, in quartzose veins, associated or not, as the case may be, with other sulphides, and in the Mancayan ore, closely connected with the sulpho-salts of copper which constitute the ore of that region. While, as has been before noted, the pyrite of Suyoc is not worked for gold by the natives, not enough samples of it have been taken to demonstrate that it carries no values. As noted before, it is as yet undetermined just what relationship the pyrite and the gold values have, but as this district opens up more information on the point will be obtained, it is presumed.

Galena or galenite.—Lead glance, "lead." Comp. PbS, lead·sulphide=lead 86.6, sulphur 13.4=100. Isometric, cubes predominating. Perfect cubic cleavage. Massive, granular, or finely granular, occasionally fibrous. Color, lead gray. H.=2.5–2.75. Sp. gr., 7.4–7.6. Luster, metallic. Opaque. Generally argentiferous.

Galena is, compared with other minerals, not prominent in this region. On the Suyoc area alone it is observed, and here in connection with other sulphides in small amounts in quartz veins. Outside of the Suyoc area the quantity of galena occurring is practically negligible, so far.

Sphalerite.—Zinc blend, blende, black jack, "zinc." Comp. ZnS, zinc sulphide=zinc 67, sulphur 33=100. Isometric, tetrahedral, commonly massive; cleavege granular to compact. Brittle. H.=3.5–4. Sp. gr., 3.9–4.1. Luster, resinous. Color, commonly yellow to black. Transparent to translucent. Occurs in considerable amounts in the Suyoc area, in conjunction with sulphides of copper, lead, and iron.

Chalcocite.—Copper glance. Comp. Cu_2S=copper 79.8, sulphur 20.2=100. Orthorhombic crystals, pseudo-hexagonal, twinning. Massive granular to compact. Brittle.

Luster, metallic. Color, lead gray, often tarnished blue or green. Opaque. H.= 2.5–3. Sp. gr., 5.5–5.8.

Occurs in the Mancayan area with other copper minerals.

Bornite.—Purple copper ore, peacock copper. Comp., a sulphide of iron and copper, variable (Cu_3FeS_3=sulphur 28.1, copper 55.5, iron 16.4=100). Isometric, cubic. Massive, granular, or compact. Brittle. H.=3. Sp. gr., 4.9–5.4. Luster, metallic. Color, copper red to brown, iridescent. Opaque.

Observed mineralogically, with other copper minerals of Mancayan.

Chalcopyrite.—Copper pyrite, yellow copper. Comp. $CuFeS_2$=sulphur 35, copper 34.5, iron 30.5=100. Sulphide of iron and copper, variable, due to admixtures. Crystals commonly tetrahedral. Massive, compact. Brittle. H.=3.5–4. Sp. gr., 4.1–4.3. Luster, metallic. Color, brass yellow, often tarnished. Opaque.

This is present in variable amounts throughout the district. Generally in quartz veins associated with other sulphides.

Tetrahedrite.—Gray copper. Comp. 4 Cu_2S, Sb_2S_3=sulphur 23.1, antimony 24.8, copper 52.1=100. Composition variable. Sulphide of copper and antimony. Isometric, tetrahedral. Rather brittle. Luster, metallic. Color, flint gray to tin black. Opaque, translucent (red) in thin splinters. H.=3.4. Sp. gr., 4.4–5.1. Arsenic and antimony are generally present and composition of this mineral is extremely variable. The high percentage of copper in this mineral (approximately 52 per cent), as well as its abundant occurrence in the mine of the Cantabro-Filipino Company at Mancayan, makes this one of the most important of the region. It is also found in the Suyoc area, on various claims of that region.

Enargite.—Comp. Cu_3AsS_4 or 3 Cu_2S, A_2S_5=sulphur 32.6, arsenic 19.1, copper 48.3= 100. Orthohombric, crystals usually small and striated. One perfect cleavage. Brittle. H.=3. Sp. gr., 4.43–4.45. Luster, metallic. Color, grayish black to iron black. Opaque.

This mineral, as well as tetrahedrite and other copper-sulphur salts, constitutes the greater part of the large ore body of the Mancayan mine. Occurring with this is luzonite, composed essentially as enargite, but differing in crystallization.

Several analyses of the typical ore from the Mancayan mine are given below:

	I.	II.	III.	IV.	V.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Insoluble residue	....	49.19	55.93	66.72	30.10
Silica	47.06	45.91	45.31	64.53	23.40
Sulphur	24.44	20.36	15.40	12.98	23.58
Antimony (metallic)	5.12	None.	None.	None.	None.
Arsenic (metallic)	4.65	2.26	.43	1.80	.40
Iron (metallic)	1.84	14.25	8.98	8.96	11.13
Copper (metallic)	16.64	13.90	16.54	9.72	32.92
Lead (metallic)	....	None.	None.	None.	None.
Loss	.25	....	....	....	....
Total	100	99.96	97.28	100.18	98.13
Gold (ounce)	....	0.23	0.16	0.08	0.04
Gold value, at $20.67	....	$4.75	$3.31	$1.65	$0.83

No. I is from Santos's Informe (p. 38) and is given as the mean composition of the different ore breasts of the native workings.

II is a piece of ore from the "Carmen" workings of the Santa Barbara mine, Mancayan, selected as typical.

III is a sample taken of the ore the natives (Igorots) use in their smelting, probably from different portions of the Mancayan mine.

IV is another sample taken as typical of the "Santa Barbara" ore.

V is a rounded bowlder of apparently almost pure copper mineral; to the glass it reveals only crystallized enargite, with some very slight amount of quartz and an occasional bunch of chalcocite.

It is not known by whom the analysis was made for Mr. Santos. The analyses numbered II to V, inclusive, are from the Bureau of Government Laboratories, Manila, to which work of this character is submitted.

Another specimen of ore was examined[a] mineralogically by Dr. W. E. Ford, of Yale University, with the following result:

"The specimens show the characteristic crystals of enargite in the cavities. They are elongated parallel to the vertical axis and show their orthorhombic character by the shape of their cross section. For the most part the faces are not well developed, the prism zone showing the deep striations characteristic of the mineral. The blowpipe tests agree with those required by enargite.

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[a] Courtesy of Prof. Joseph Barrell, Yale University. This analysis confirms that previously made by H. M. Ickis, of the Mining Bureau.

"The most prominent mineral of the specimens is a massive mineral which on a weathered surface has a dull-bronze color, but which on a fresh fracture shows a reddish-gray tone. No evidences of crystallization could be discovered. Its fracture is uneven. Its blowpipe and chemical reactions are identical with those of enargite; it decrepitates in the closed tube and gives sublimates of sulphur and arsenic sulphide; with nitric acid and ammonia it gives the deep-blue solution indicating copper. Its appearance and reactions agree with those described for the mineral luzonite."

It seems rather remarkable that none of the four analyses above quoted show any traces of antimony, as between the arsenical and antimoniacal sulpho-salts of copper there is a constant variation and transition, and rarely, if ever, is one known without the other. Santos gives 5.12 per cent of antimony, and it seems highly probable that this better represents the composition of the ore. The analyses, however, are quoted as reported[a]

Of superficial decomposition products there is in this region but little trace; occasional bunches of iron and copper carbonates and sulphates are found, but only in limited quantities. The geology of the region, as will be shown later, precludes any oxidized croppings of any but occasional veinlets, and, except for scattered points and sections of the underground workings of the old Mancayan mine, decomposition products are singularly lacking.

DISTRIBUTION AND RELATIONS OF VEINS.

Of the ore deposits in the Lepanto area, and in fact in northern Luzon, that of Mancayan has been most known and is most prominent. The occurrence there of copper ore has led to further search in the vicinity, and while the Mancayan deposit is at present far beyond any other locality in size and value, the future may develop more extended masses of ore here or in other localities.

The Mancayan deposit has been uncovered for a long time by the Mangambang (Igorot, meaning "copper") River cutting a deep gorge diagonally across the southeast end of a quartzose mass bearing copper ores. At this place there is a nearly vertical wall of 100 or 200 feet, the strike of which, coinciding approximately with the course of the river, is northwest. From mining operations of past years there is a heavy talus and dump pile, and the face of the cliff is pierced by numerous tunnels, some of them mere dog holes, others cut with precision and good workmanship. Several systems of levels explore most of the ore body, the lowest one serving for the purpose of drainage. In the many years of operation of this mine several thousand feet of workings have been made and a considerable amount of ore extracted.

There is no indication of a regular form to the deposit, except that from a tunnel on the west side of the northern extension of the main deposit it is seen that the quartzose mass evidently dips 10° to 15° to the east, resting on the Mancayan diorite.

Much of the mine was flooded at the time of the visit, and without maps of the workings other than the one included in the report which was made of some of the principal galleries, it is only possible to draw general inferences as to the nature of the deposit.

The siliceous mass constituting the outcrop is apparently the same in character as the quartz porphyry described under "Rocks." At the Mancayan mine it loses its lithoidal nature and consists more or less entirely of quartz and ore minerals. The quartz has been previously shattered and jointed in every direction, and the cracks filled with either secondary quartz or ore minerals, notably pyrite, marcasite, chalcopyrite, and enargite. The mass at present is hard, compact and firm, woven through with irregular veins of ore, with no system of distribution. The fissures, broadly speaking, have west-northwesterly and northeasterly directions, and of these the ones striking west-northwest seem to be most prominent as ore carriers.

The fissures would suggest contraction types due to cooling of an igneous effusion, dehydration of a mass, or some similar phenomenon, rather than those produced by dynamic causes. The fracturing has no other pronounced direction than that noted, and even this appears more or less forced.

This fracturing seems not to be confined entirely to the ore body, but is a characteristic of much of the surrounding rock mass. There is apparently no profound fissuring or faulting in the locality, and as yet no evidence is available that other displacement than the local fractures of the Mancayan ore deposit exist.

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[a] A second examination of Nos. III and V, for the presence of antimony, gave 0.11 per cent and 0.06 per cent metallic antimony, respectively; a "trace" in Nos. I and IV.

The "veins" formed by the recementation of the quartzose mass by silica and metallic sulphides vary from finger-breadth cracks to one body (the largest opened) over 20 feet across, of lens shape, of limited depth and length. There is no continuity of these singly, and the workings therefore follow the Spanish method and are crooked and narrow, following rich seams.

Unfortunately for a thorough investigation, many of the galleries were flooded or caved, and the exact relation of the deposit could not be made out. One important observation is worth recording: The lowest tunnel, a regular and large gallery, driven for drainage, has in its present length, and in the side drifts, which are under the greater part of the other workings, no signs of ore—in decided contrast to the rich values of a few feet above; the explanation of this is not certain.

From the nature of the ore masses, it is evident that the enargite and chalcopyrite and some quartz have been formed around the earlier particles of pyrite and quartz. The enargite is well crystallized and undoubtedly later than the pyrite inclosing the latter.

From the few assays made it would seem to be indicated that the values in gold come from the pyrite, as the assay of a bowlder of almost pure enargite from the mine give but little value, those samples of which a portion was pyrite showing values up to $5 a ton in addition to their copper content.

In the immediate vicinity of Mancayan there are but few openings of any depth or length, and only negative results are obtained from these. The western slope of the hill is predominantly an outcrop of the quartz prophyry, copper bearing to a mile north of Mancayan mine in variable amounts, and so far as shown decreasing in content to the north. No shafts deeper than a few feet have been sunk over the deposit, or in its vicinity, and these reveal only the soft material derived from the weathering of the trachyte. The tunnels on the east slope of the hill are driven in Mancayan diorite, and when the party left the field were still in that material, so that, except from the Mancayan mine proper, nothing is known of the extent of the deposit.

On the north slopes of Mancayan hill crop two exposures of the same vein, a 2-foot fissure of quartz, heavily loaded with pyrite and some chalcopyrite, the strike of which is east and west. No exploration has been made of this.

South of Mancayan, just west of Tuboc, conditions similar to those of the Mancayan outcrops prevail. There is there a standing face, 150 feet in height, of the same quartzose mass, but the rich ore seems entirely lacking, and the tunnels driven into it to the west so far have not shown other than promising indications.

At Cayan large slides and workings indicate that formerly values were sought, and the quartz-mass outcrops are of a slightly different character. The rock is more cellular in structure and is impregnated with pyrite only. Gold values obtain, and it is stated by reliable authority that these ores were mixed with the Mancayan ores in the blast furnace, on account of their siliceous and pyritiferous character. As the ground is well covered with Spanish pertenencias, no prospecting work has been done of late years.

The ores of the district alter perceptibly as more southerly points are reached, and in addition to the change noted at Cayan, Suyoc and its surrounding territory offer a decided contrast to the Mancayan type.

North of Suyoc, between it and Cayan, the ore-bearing veins are well-defined quartz leads, of small width, generally not over three feet, with a content of lead, zinc, and iron sulphides. No general direction of these veins can be traced, but it is the opinion of several of the miners in the district that those corresponding more closely to an east and west strike give the greater values. The length of the veins is limited, and no depth beyond a few feet has yet been explored. The "country rock" is here the Mancayan diroite, much decomposed and altered, and the presence of veins of gypsum up to widths of several feet is noteworthy. Several acres of this territory have been cut down rapidly by the combined efforts of the rainy season and the Igorots in their workings, and an enormous slide results, the material being washed down the narrow gorge to join the Maanse River. Every rainy season the Igorots impound this water at the end of long ditches, "boom" away the overlying muck, and obtain a considerable amount of free gold by crushing and panning the vein material. It may be noted in this connection that an assay of the material the Igorot discarded as of no value yielded 0.20 ounce of gold per ton, a value of $4.03. Numerous pockets have been found in this slide that were surprisingly rich, it being stated that 20 *pounds* of metal was taken from one such occurrence a few years ago.

The Suyoc hill deposits, as yet only partially prospected, have the same general character—quartz veins of no great width, carrying metallic sulphides, and a considerable gold content, most of it in a free state. In two notable instances, on the "Eureka" claim of Mr. C. A. Pettit and the "Quien Sabe" of Mr. Albert Wright, copper sulphides form a great proportion of the vein filling, and these and the other properties are being developed by tunnels.

All along Suyoc hill, west and south of the Abra River, are large eroded cirques, owing their existence primarily to ancient workings, and all of the same general type.

In view of the fact that the entire region, with the exception of the one ore body of the Mancayan mine, is in an early stage of development, it is impracticable to treat the ore deposits in detail. It seems to be fairly conclusive, however, that the general type of vein in the district is a narrow quartz lead, carrying metallic sulphides, in some cases of copper, and generally with gold associated in a free state. These veins are in the Mancayan diorite which underlies the entire district. With the advent of the trachyte flow, metamorphic changes have taken place, and the nature of the country rock altered to a considerable degree.

It would be rash to enter into a discussion of the genesis of the deposits on the meager data available, and in consequence such will be left to more complete reports that will follow detailed geological work upon a topographic base.

The former attempts to explain the Mancayan deposit have been given and objections to each have been found, and as a mere tentative hypothesis may be suggested a genesis of these ores as yet not considered, that will be determined when further development work is done. It is entirely within the grounds of probability, and not in conflict with any geological evidence so far at hand, to presume that, before the advent of the trachyte flow, ore deposits had been formed in the Mancayan diorite of a type similar to those at Suyoc—quartz veins carrying metallic sulphides and gold values. With the covering of the diorite and its veins by an igneous flow, chemical action was given an added impetus. The trachyte, easily decomposed and altered, was metamorphosed at its contact with the diorite to a hard, flinty, siliceous quartz porphyry, quartz replacing most of the other constituents of the rock. In its cooling and subsequent contraction fissures and crevices were formed, aided possibly by dynamic action, such as shattering rocks, which are a feature of the islands. The heat of the overlying trachyte furnished a motive power for the process of vein deposition, and the heated waters, assumed to be rising, filled the cavities and cracks with silica and ore minerals obtained from lower or surrounding sources. Enargite is a prominent mineral among those formed by secondary action, and investigation shows that it has been formed later than the other minerals; so that the evidence points to a secondary enrichment of certain portions of the contact, notably at Mancayan, with copper minerals obtained from other sources. Deposition has taken place in all possible directions, leaving the irregular mass of veins of the Mancayan mine.

There is nothing in this hypothesis to preclude the possibility of other similar deposits in other portions of the area, or, indeed, of one or more veins, as yet not opened, in a more or less vertical position, which may occur under the rachyte, in the diorite, and which afforded a main trunk channel for the ore-depositing solutions. Where erosion has been sufficiently deep to cut down near the diorite, such deposits may be revealed, but it is obviously useless to prospect in the trachyte surface, which is easily recognized by its granularity, color, and weathering to a characteristic clayey soil. Deep shafts through the trachyte, or proper crosscuts, at a depth easily to be obtained, will afford the only solution of the future of this district, and it is to be hoped that the efforts of those at work will be carried on to completion.

Chapter VII.

SUMMARY.

For a mining district which has been under exploitation for four or five years, the Mancayan-Suyoc area has surprisingly little development. Much of this lack of progress is due to natural conditions which prevail, but to some extent at least there is or has been a lack of initiative to put forth real effort. Assessment work has been done as assessment work, in disconnected pits and tunnels in the softest material that could be found, instead of combining each year's labor with that of the preceding to attain needed information. The net result is that the area presents an unsatisfactory aspect to the engineer who wishes to ascertain facts. Natural conditions in the Philippine Islands are invariably arrayed against the miner, the engineer, and the goelogist; and when such conditions have to be faced, and in addition there is a dearth of developed information, but little may be had to aid the judgment. It does by no means follow that a fine showing of a prospect indicates a fine future, and conversely that a poor prospect is doomed to failure. Rarely does it occur that on an area so little developed as this enough data can be found to venture an authoritative opinion, and it is a fortunate state of affairs when condemnation or approval may be urged without reservation. While a natural allowance must be made for an enthusiastic spirit, there is still a great deal of truth in the current belief of the miners that this area "shows better surface indications" than any region of their experience. There is no doubt that, considered solely as "prospects," the greater proportion of the staked-out claims are well worth considering. Of vital importance to the future prosperity of this region is the solution of several difficult problems. Provided more ore bodies of sufficient size and value are found, operators are faced with no small trouble of labor and transportation, with their directly depending questions of cost, profit, and treatment.

The labor problem in the Philippine Islands is one that up-to-date has not proven an insurmountable obstacle, but the location of this region adds a new phase to the problem which heretofore has not been considered. Throughout the Philippines as a whole it is the general consensus of opinion that Filipino labor can profitably be used when proper treatment and supervision are employed.

On the road work in a large proportion of the provinces, Filipinos of various race have been employed, and with a single exception reports have been very satisfactory. Mr. N. M. Holmes, after three years of observation as chief engineer of the Benguet road, condemns the Filipino laborer from every point of view. It is believed, however, that there were factors in that period which no longer have to be considered, as during the completion of the same enterprise, under the supervision of Maj. L. W. V. Kennon, United States Army, as chief engineer, reports as to the native labor employed were decidedly favorable.

The Atlantic, Gulf and Pacific Company, using up to 1,000 men, have, according to the report of Mr. H. Krusi, the vice-president, met with unqualified success. The Cavite navy-yard, also using large numbers of Filipino laborers, has, according to the report of Captain Couden, United States Navy, been equally successful in meeting the problem. The Manila Electric Railway and Lighting Company, in its construction and operation of about 60 kilometers of line, have used Filipinos from the start with like success. In all these works effort has been made to provide for the wants of the Filipino to make life as comfortable as possible under the conditions, and to learn and apply the proper supervision.

Of more pertinence to this report is the unqualified statement of all at present engaged in mining operations that Filipino labor not only may be endured, but that it bears comparison with other races. In Benguet, Masbate, Camarines, and other districts, Filipinos are being used; in other districts native labor has been employed in the past; and all with good results. The keynote seems to be successful and competent supervision, with as much careful study of native characteristics as would be given to any other little-known problem.

That the proper use of native labor reduces considerably the costs involved can not be denied, and this factor can not be neglected.

As has been stated previously, however, the problem in Lepanto has conditions peculiar to itself, which should be carefully considered. It may be said in the beginning that dependable labor, certain in supply and quality, can not be obtained locally. There is, it is true, a large population, most of them used to labor, to draw upon for limited or occasional demands, but that local supply will meet the demand of extensive mining operations, steadily and with the requisite intelligence, seems extremely doubtful, at least. This applies to the regular forms of more or less skilled labor which mining operations depend upon for their very existence.

Employment of white foremen and white skilled labor will be found necessary. The employment of Chinese and Japanese has met with a certain measure of success in other parts of the islands, and the recent importations of East Indians, Tartars, and other races into South Africa to relieve labor troubles there is suggestive of possibilities.

Transportation at present, with but slight exception in the way of native porters or "cargadores," may be marked nil. Transport in both directions, supplies in and product out, must be considered. The present lines of travel are horse and foot trails, and the distance to the coast (about 40 miles) makes packing excessively expensive. Direct railroad projects seem unfeasible, and a railroad down the Abra Valley, with its terminus at Vigan, has been considered as questionable. The nearest light in that direction would seem to be an examination of the route between Lepanto and the capital of Benguet Province to the south, Baguio. There has been completed a superb wagon road from the northern terminus of the railroad, Dagupan, to Baguio, and the railroad continuation, probably under electric motive power, is assured within a short time. Mancayan and Baguio are about on the same level at an altitude of 5,000 feet, and the existence of a route along the mountain ridge between the two is very probable. It is expected that the present field work of the Bureau will throw light on this suggestion, and at all events the question of routes and costs can not be abandoned so lightly. It will take careful examination of known routes, and equally careful search over newer routes, before assurance may be had as to either result. It is not believed, however, that the difficulty is insurmountable.

The solution of these two most important problems will practically eliminate the remaining obstacles. There is in the district water in sufficient quantities for considerable power, and by transmission from a small distance the whole power of the Abra River may be utilized in a combination of hydraulic and electric methods.

It is doubtful if steam could be furnished at the mines for any considerable amount of call upon it. Former smelting operations and lack of preservation have removed the timber from the whole valley of the Abra, and while it is believed that plenty of wood fuel is within a reasonable distance, it would take careful calculation before any design of power plants could be considered.

We have, then, the consideration of a district whose prospects certainly appear of a favorable nature. There are numerous obstacles to be overcome, but all of them, it is believed, may be handled if the one vital problem, of the presence of the ore, is settled. Given the ore, large and valuable enough, and the remainder of the problem becomes one of adaptation and engineering.

The old Mancayan mine was, without doubt, an extraordinarily rich deposit, and the quantity of ore still remaining is worthy of examination. The ore dump, of huge size, contains ore that was then discarded, but under new conditions represents in itself a small mine of fair grade. The old smelter sites and slag dumps are rich with such material as slags containing as high as 32 per cent of copper, and further underground work may reveal more ore bodies. So far as the work already done goes, much may be hoped for the rest of the district—everything depends upon further exploration. In many cases mining properties may be condemned very quickly by an examination. but the Mancayan-Suyoc area is far from being one of these. While positive assurances of a future are lacking, no efforts should be spared, and no amount of skilled exploration neglected to ascertain more; the district is decidedly not to be classed as of little value, and within a short time, under the scheme of exploitation planned, an ore-producing district of considerable magnitude and richness may not be unlooked for.

NOTE.—The following illustrations accompanying this report are on file in the War Department.

PLATE I. Map showing route of party.
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6. Topographic map of Mancayan-Suyoc area (Pl. XLIII).

CIRCULARS

CONTAINING THE

LAWS AND INSTRUCTIONS CONCERNING THE LEASING OF PUBLIC LANDS AND HOMESTEADS.

BUREAU OF PUBLIC LANDS.

CIRCULAR CONTAINING THE LAWS AND INSTRUCTIONS CONCERNING THE LEASING OF PUBLIC LANDS, ISSUED NOVEMBER 7, 1904.

Department of the Interior,
Bureau of Public Lands,
Manila, P. I., October 11, 1904.

The following compilation of laws and instructions relative to leasing the public lands are issued under authority of section sixty-nine of "the public land act," act No. 926, for the information of the public and the guidance of public officers engaged in the administration of the laws.

LAWS.

ACT OF CONGRESS OF JULY 1, 1902.

Sec. 13. That the Government of the Philippine Islands, subject to the provisions of this Act and except as herein provided, shall classify according to its agricultural character and productiveness, and shall immediately make rules and regulations for the lease, sale, or other disposition of the public lands other than timber or mineral lands, but such rules and regulations shall not go into effect or have the force of law until they have received the approval of the President, and when approved by the President they shall be submitted by him to Congress at the beginning of the next ensuing session thereof and unless disapproved or amended by Congress at said session they shall at the close of such period have the force and effect of law in the Philippine Islands: *Provided*, That a single homestead entry shall not exceed sixteen hectares in extent.

* * * * * * *

Sec. 75. That no corporation shall be authorized to conduct the business of buying and selling real estate or be permitted to hold or own real estate except such as may be reasonably necessary to enable it to carry out the purposes for which it is created, and every corporation authorized to engage in agriculture shall by its charter be restricted to the ownership and control of not to exceed one thousand and twenty-four hectares of land; and it shall be unlawful for any member of a corporation engaged in agriculture or mining and for any corporation organized for any purpose except irrigation to be in any wise interested in any other corporation engaged in agriculture or in mining. Corporations, however, may loan funds upon real-estate security and purchase real estate when necessary for the collection of loans, but they shall dispose of real estate so obtained within five years after receiving the title. Corporations not organized in the Philippine Islands, and doing business therein, shall be bound by the provisions of this section so far as they are applicable.

ACTS OF THE PHILIPPINE COMMISSION.

[Act No. 926.]

Chapter III.—*Leases of portions of the public domain.*

Sec. 22. Any citizen of the United States, or of the Philippine Islands, or of any insular possession of the United States, or any corporation or association of persons organized under the laws of the Philippine Islands or of the United States or of any State, Territory, or insular possession thereof, authorized by the laws of its creation and by the laws of the Philippine Islands and the Acts of Congress applicable thereto to transact business in the Philippine Islands, may lease any tract of unoccupied, unreserved, nonmineral agricultural public lands, as defined by sections eighteen and twenty of the Act of Congress approved July first, nineteen hundred and two, providing a temporary government for the Philippine Islands, and so forth, not exceeding one thousand and twenty-four hectares, by proceeding as hereinafter in this chapter indicated: *Provided*, That no lease shall be permitted to interfere with any prior claim by settlement or occupation until the consent of the occupant or settler is first had and obtained, or until such claim shall be legally extinguished: *And provided further*, That no corporation or association of persons shall be permitted to lease lands hereunder which are not reasonably necessary to enable it to carry on the business for which it was lawfully created and which it may lawfully pursue in the Philippine Islands.

SEC. 23. Leases made under the provisions of this chapter, of land previously surveyed, must be made of contiguous legal subdivisions. All lands leased hereunder, whether previously surveyed or not, in case the tract sought to be leased exceeds sixty-four hectares in area, must be taken, where possible, in the form of contiguous squares which shall contain at least sixty-four hectares each: *Provided*, That in connection with the lease of lands in one or more tracts of sixty-four hectares there may be leased one rectangular tract of thirty-two hectares, the longer side of which must be contiguous to the square tract of sixty-four hectares. or to one of such tracts if more than one be leased. In no case may lands leased under the provisions of this chapter be taken so as to gain a control of adjacent land, water, stream, shore line, way, roadstead, or other valuable right which in the opinion of the Chief of the Bureau of Public Lands would be prejudicial to the interests of the public.

SEC. 24. An application to lease land under this chapter must be executed under oath and filed with such officer as may be designated by law as local land officer of the district in which the land is situated, or in case there be no such officer then with the Chief of the Bureau of Public Lands, and must show the following facts: The citizenship and post-office address of the applicant; the location of the land, showing the province, municipality, and barrio in which the same is situated, and as accurate a description as may be given, showing the boundaries of the land, having reference to natural objects and permanent monuments, if any; a statement as to whether the land contains any improvements or evidences of settlement and cultivation, and a statement that it is nonmineral in character, more valuable for agricultural than for forestry purposes, and does not contain deposits of coal or salts. Corporations and associations shall be required to file evidence of their legal existence and authority to transact business in the Philippine Islands.

SEC. 25. All applicants for leases under the terms of this chapter must give notice, by publication and by such other means as may be required by the Chief of the Bureau of Public Lands, with the approval of the Secretary of the Interior, of intent to make application to lease the tract in question, which notice shall state the date when the application will be presented and shall describe as definitely as practicable the land sought to be leased.

SEC. 26. It shall be the duty of the Chief of the Bureau of Public Lands to examine all applications for leases under this chapter, and to determine whether the applicant has the qualifications required in section twenty-two hereof, and, from the certificate of the Chief of the Bureau of Forestry, to determine whether the land applied for is more valuable for agricultural than forestry purposes, and further summarily to determine from available records whether the land is nonmineral and does not contain deposits of coal or salts. He shall report his findings to the Secretary of the Interior, who, after proper consideration and approval of same, shall cause the lease to be executed.

SEC. 27. The rate per hectare per annum for lands leased under this chapter shall be fixed by the Chief of the Bureau of Public Lands, with the approval of the Secretary of the Interior, and shall in no case be less than fifty centavos, Philippine currency, per hectare per annum; said rent shall be paid yearly in advance, the first payment being deposited with the Chief of the Bureau of Public Lands before the delivery of the lease.

SEC. 28. Leases hereunder shall run for a period of not more than twenty-five years, but may be renewed for a second period of twenty-five years, at a rate to be fixed as above indicated, which rate shall not be less than fifty centavos per hectare and shall not exceed one peso and fifty centavos, Philippine currency, per hectare. Land leased hereunder shall not be assigned or sublet without the consent of the Chief of the Bureau of Public Lands and the Secretary of the Interior.

SEC. 29. No land shall be leased under the provisions of this chapter until the land has been surveyed under the direction of the Chief of the Bureau of Public Lands and an accurate plat made thereof, the cost of survey to be borne by the lessee.

SEC. 30. The lease of any lands under this chapter shall not confer the right to remove or dispose of any valuable timber except as provided in regulations of the Bureau of Forestry for cutting timber upon such lands. Nor shall such lease confer the right to remove or dispose of stone, oil, coal, salts, or other minerals, but the lease as to the part thereof which shall be mineral may be canceled by the Chief of the Bureau of Public Lands, with the approval of the Secretary of the Interior, whenever the mineral character of such part shall be made satisfactorily to appear, after due notice to the lessee.

SEC. 31. The commission of waste or the violation of the forestry regulations by the lessee shall work a forfeiture of his last payment of rent and render him liable to immediate dispossession and suit for damage.

The civil governor was advised by the chief of the Bureau of Insular Affairs, Washington, D. C., by cablegram dated May 4, 1904, that Congress had adjourned without amending or disapproving the public land act (act No. 926). On July 26, 1904, the civil governor issued his proclamation declaring the public land act to be in full force and effect from said date, as contemplated by section 13, Act of Congress of July 1, 1902, above stated.

INSTRUCTIONS.

LANDS SUBJECT TO LEASE.

All unoccupied, unreserved, nonmineral public lands, more valuable for agricultural than forestry uses, are subject to lease. Public lands are such lands of the government as are subject to disposal under general laws. Mineral lands are such lands as are chiefly valuable for the minerals they contain. Whether lands upon which there is growing timber are more valuable for agricultural than for forestry uses will be determined by the forestry bureau. (See sec. 18, act of Congress of July 1, 1902.)

Owing to the system of disposing of public lands which obtained under the Spanish Government in these islands, the present government has no maps showing the exact location of public lands; therefore, prospective lessees will be compelled to make inquiries as to the ownership of any particular tract desired of persons living in the vicinity thereof, and to consult the property register and record of tax returns, in the capital of the province in which the land is located, for evidence of ownership.

No lease will be permitted to interfere with any prior claim by settlement or occupation until the consent of the occupant or settler is first had and obtained, or until such claims shall be legally extinguished.

The provisions of the public land act relating to leasing public lands do not extend, at the present time, to the provinces of Lepanto-Bontoc, Benguet, Paragua, Nueva Vizcaya, and the Moro Province, but may at any time, by resolution of the Philippine Commission, be extended to said provinces.

PERSONS WHO MAY LEASE PUBLIC LANDS.

(1) Citizens of the Philippine Islands; (2) citizens of the United States; (3) citizens of any insular possession of the United States; (4) any corporation or other association of persons organized under the laws of the Philippine Islands or of the United States, or of any State, Territory, or insular possession thereof, authorized by the laws of its creation and by the laws of the Philippine Islands and the acts of Congress applicable thereto to transact business in the Philippine Islands. In this connection see section 75, act of Congress of July 1, 1902, supra, as to rights of corporations.

AMOUNT THAT MAY BE LEASED.

A qualified person may lease any amount not exceeding 1,024 hectares, equivalent to about 2,530 acres.

PERIOD OF LEASE.

Leases shall run for a period of not more than twenty-five years, but may be renewed for a second period of twenty-five years.

RENT.

Lessees will be required to pay an annual rent in advance, the amount of which will be fixed by the chief of the bureau of public lands, with the approval of the Secretary of the Interior, but it can in no case be less than 50 centavos, Philippine currency, per hectare, and during the second period can not exceed ₱1.50 per hectare. The first payment of rent is due on the date of the execution of the lease, and must be paid before the lease is delivered.

FORM IN WHICH LEASED LANDS MUST BE TAKEN.

Leased lands, in all cases where possible, must be taken in tracts compact in form as provided in section 23 of the public land act. Tracts to be contiguous must have one boundary in common. The purpose of this provision is to prevent the taking of land in long or irregular strips whereby adjoining public lands would be decreased in value.

PROCEDURE IN MATTER OF OBTAINING LEASE.

Prospective lessees are required to file an application for the land desired with the chief of the bureau of public lands. This application must show that the applicant is qualified to lease public lands; must describe the land desired to be leased, with respect to both its location and character, as definitely as practicable, and must be executed under oath. A proper form to be used in making application will be furnished on request by the bureau of public lands.

Applicants must give notice of intention to apply for a lease by publication for thirty days in two newspapers, one English and one Spanish. Said newspapers shall be of general circulation in the locality where the land is located. When the notice is published in a weekly newspaper, five consecutive insertions are necessary; when in a daily newspaper, the notice must appear in each issue for thirty-one consecutive issues. Said notice shall state the date when said application will be made, and shall describe as definitely as possible the land to be applied for; an approved form may be found at the close of this circular. Applicant must file a copy of the notice at the same date at which he begins the publication of same with the provincial secretary and municipal president of the province and municipality in which the land is located. In case the land is located within the city of Manila, said notice must be filed with the secretary of the municipal board.

Applicant must submit to the chief of the bureau of public lands with his application a copy of said notice, and must show by affidavit of the manager of the newspaper in which same was published that it was published for the required period.

The application will be examined in the bureau of public lands, and if found correct will be referred to the forestry bureau for report as to whether the land is more valuable for agricultural than for forestry purposes.

Upon return of the application to the bureau of public lands from the forestry bureau, with a report that the land is more valuable for agricultural than forestry uses, the chief of the bureau of public lands will, with the approval of the Secretary of the Interior, fix the rate per hectare at which the government will lease the land. He will then advise the applicant of the rate fixed, also of the probable cost of surveying the tract.

Upon deposit by applicant in the bureau of public lands of the amount of the estimated cost of survey the chief of said bureau will advise applicant of the date when he will cause the survey to be made, and will also send a copy of said notice to the secretary of the province and one to the president of the municipality in which the land is located, requesting said officials to post said notices in a conspicuous place in their respective offices.

Upon completion of the survey, in case there are no adverse claims to the land, a lease will be executed therefor as early as practicable.

MISCELLANEOUS.

A lessee of public lands has no right to remove timber except as authorized by the forestry bureau.

No minerals may be removed from public lands under a lease. In case it is made to appear that leased lands contain valuable mineral deposits, the chief of the bureau of public lands, with the approval of the Secretary of the Interior, is authorized to cancel the lease as to such lands.

Attention is invited to the fact that section 77 of the public land act prescribes a penalty for the presentation of false proof or affidavits in connection with applications or claims respecting public lands.

All necessary forms to be used in connection with the leasing of public lands may be had on application to the bureau of public lands.

WILL M. TIPTON,
Chief Bureau of Public Lands.

Approved, November 7, 1904.
DEAN C. WORCESTER,
Secretary of the Interior.

NOTICE OF APPLICATION TO LEASE PUBLIC LANDS.

The undersigned hereby gives notice that he will on the........................ day of.., 19.., file with the chief of the bureau of public lands, Manila, P. I., an application for a lease to the following-described public land, beginning..
....

[Here give description as definitely as possible.]

....
....
located in the barrio of..., municipality of................................, province of.......................................,
and containing...hectares, more or less.
Signature of applicant..
Post-office address..

BUREAU OF PUBLIC LANDS.

CIRCULAR CONTAINING THE LAW RELATING TO HOMESTEADS AND INSTRUCTIONS THEREUNDER, ISSUED NOVEMBER 7, 1904.

Department of the Interior,
Bureau of Public Lands,
Manila, P. I., October 12, 1904.

The following compilation of laws and instructions thereunder relative to the acquiring of public lands as a homestead, is issued under authority of section 69 of the public land act, act No. 926, United States Philippine Commission, for the information of the public and the guidance of public officials engaged in the administration of the laws.

LAWS.

ACT OF CONGRESS OF JULY 1, 1902.

Sec. 13. That the Government of the Philippine Islands, subject to the provisions of this Act and except as herein provided, shall classify according to its agricultural character and productiveness, and shall immediately make rules and regulations for the lease, sale, or other disposition of the public lands other than timber or mineral lands, but such rules and regulations shall not go into effect or have the force of law until they have received the approval of the President, and when approved by the President they shall be submitted by him to Congress at the beginning of the next ensuing session thereof and unless disapproved or amended by Congress at said session they shall at the close of such period have the force and effect of law in the Philippine Islands: *Provided*, That a single homestead entry shall not exceed sixteen hectares in extent.

ACTS OF THE PHILIPPINE COMMISSION.

[Act No. 926.]

CHAPTER I.

HOMESTEADS ON THE PUBLIC DOMAIN.

Section 1. Any citizen of the Philippine Islands, or of the United States, or of any insular possession thereof, over the age of twenty-one years or the head of a family, may, as hereinafter provided, enter a homestead of not exceeding sixteen hectaras of unoccupied, unreserved, unappropriated agricultural public land in the Philippine Islands, as defined by the Act of Congress of July first, nineteen hundred and two, entitled "An Act temporarily to provide for the administration of the affairs of civil government in the Philippine Islands, and for other purposes," which shall be taken, if on surveyed lands, by legal subdivisions, but if on unsurveyed lands, shall be located in a body which shall be as nearly as practicable rectangular in shape and not more than eight hundred meters in length; but no person who is the owner of more than sixteen hectares of land in said Islands or who has had the benefits of any gratuitous allotment of sixteen hectares of land since the acquisition of the Islands by the United States shall be entitled to the benefits of this chapter.

Sec. 2. Any person applying to enter land under the provisions of this chapter shall file with such officer as may be designated by law as local land officer, or in case there be no such officer then with the Chief of the Bureau of Public Lands, an application under oath showing that he has the qualifications required under section one of this chapter, and that he possesses none of the disqualifications there mentioned; that such application is made for his exclusive use and benefit; that the same is made for the purpose of actual settlement and cultivation, and not, either directly or indirectly, for the use or benefit of any other person, persons, corporation, or association of persons; that the land applied for is nonmineral, does not contain valuable deposits of coal or salts, is more valuable for agricultural than forestry purposes, and is not occupied by any other person; and showing the location of the land by stating the province, municipality, and barrio in which the same is situated, and as accurate a description as may be given, showing the boundaries of the land, having reference to natural objects and permanent monuments, if any. Upon the filing of said application the Chief of the Bureau of Public Lands shall summarily determine, by inquiry of the Chief of the Bureau of Forestry and from the available land records, whether the land described is prima facie subject under the law to homestead settlement, and, if he shall find nothing to the contrary, the applicant, upon the payment of ten pesos, Philippine currency, shall be permitted to enter the quantity of land specified.

SEC. 3. No certificate shall be given or patent issued for the land applied for until the expiration of five years from the date of the filing of the application; and if, at the expiration of such time or at any time within three years thereafter, the person filing such application shall prove by two credible witnesses that he has resided upon and cultivated the land for the term of five years immediately succeeding the time of filing the application aforesaid, and shall make affidavit that no part of said land has been alienated or encumbered, and that he has borne true allegiance to the Government of the United States and that of the Philippine Islands, then, upon payment of a fee of ten pesos, Philippine currency, to such officer as may be designated by law as local land officer, or in case there be no such officer then to the Chief of the Bureau of Public Lands, he shall be entitled to a patent: *Provided, however,* That in the event of the death of an applicant prior to the issuance of a patent, his widow shall be entitled to have a patent for the land applied for issue to her upon showing that she has consummated the requirements of law for homesteading the lands as above set out; and in case the applicant dies before the issuance of the patent and does not leave a widow, then the interest of the applicant in the land shall descend and patent shall issue to the persons who under the laws of the Philippine Islands would have taken had the title been perfected by patent before the death of the applicant, upon proof by the persons thus entitled of compliance with said requirements and conditions.

SEC. 4. No lands acquired under the provisions of this chapter shall in any event become liable to the satisfaction of any debt contracted prior to the issuance of a patent therefor.

SEC. 5. If, at any time after the filing of the application as hereinabove provided and before the expiration of the period allowed by law for the making of final proof, it is proved to the satisfaction of the Chief of the Bureau of Public Lands, after due notice to the homesteader, that the land entered is not under the law subject to homestead entry, or that the homesteader has actually changed his residence, voluntarily abandoned the land for more than six months at any one time during the five years of residence herein required, or has otherwise failed to comply with the requirements of law, then in that event the Chief of the Bureau of Public Lands may cancel the entry, subject to appeal under proper regulations to the Secretary of the Interior, and the land thereupon shall become subject to disposition as other public lands of like character.

SEC. 6. Not more than one homestead entry shall be allowed any one person.

SEC. 7. Before final proof shall be submitted by any person claiming to have complied with the provisions of this chapter, due notice, as prescribed by the Chief of the Bureau of Public Lands with the approval of the Secretary of the Interior, shall be given to the public of his intention to make such proof, stating therein the time and place, and giving a description of the land and the names of the witnesses by whom it is expected that the necessary facts will be established.

SEC. 8. Any person may file an affidavit of contest against any homestead entry, charging that the land entered was not unoccupied, unreserved, or unappropriated agricultural land at the time of filing the application, alleging disqualification of the entryman, noncompliance with law as to residence or cultivation, or any other matter which, if proven, would be just cause for the cancellation of the entry, and upon successful termination of the contest, the contestant, if a qualified entryman, shall be allowed a preference right of entry for sixty days from said date.

The Chief of the Bureau of Public Lands or any public official becoming aware of the existence of any of the grounds above stated, for impeaching or canceling the entry, may file formal complaint against the entry on any such ground which, if proven, shall cause the cancellation of the entry.

SEC. 9. No patent shall issue under the provisions of this chapter until the land has been surveyed under the direction of the Chief of the Bureau of Public Lands and an accurate plat made thereof, the cost of which survey shall be borne by the Insular Government.

The civil governor was advised by the chief of the bureau of insular affairs, Washington, D. C., by cablegram dated May 4, 1904, that Congress had adjourned without amending or disapproving the public land act (act No. 926). On July 26, 1904, the civil governor issued his proclamation declaring the public land act to be in full force and effect from that date, as contemplated by section 13, act of Congress of July 1, 1902, above mentioned.

INSTRUCTIONS.

1. *Location of public lands.*—Owing to the system of disposing of public lands which obtained under the Spanish Government in these islands the present government has no maps showing the exact location of such lands; therefore, prospective homestead entrymen will be compelled to make inquiries, as to the ownership of any particular tract desired, of persons living in the vicinity thereof, and to consult the property register and record of tax returns, in the capital of the province in which the land is located for evidence of ownership.

2. *Land subject to entry.*—Only unreserved, unoccupied agricultural public land is subject to homestead entry. Land chiefly valuable for the mineral it contains must be purchased under the law relating to mineral land. Whether a particular tract is more valuable for forestry than agricultural purposes will be determined by the forestry bureau on request by the bureau of public lands.

The provisions of the public land act relating to homesteads do not extend at the present time to the provinces of Lepanto-Bontoc, Benguet, Paragua, Neuva Vizcaya, and the Moro Province, but may at any time, by resolution of the Philippine Commission, be extended to said provinces.

3. *Persons entitled to a homestead.*—The following designated persons are entitled to make a homestead entry:

(*a*) Citizens of the Philippine Islands.

(*b*) Citizens of the United States, or of any insular posession of the United States.

To be entitled to make an entry a person must be 21 years of age, or else the head of a family. Any person, male or female, who is the head of a family, and otherwise qualified, may enter a homestead, even though such person be less than 21 years of age.

A person who is the owner of more than 16 hectares of land, or has received from the government a gratuitous grant of 16 hectares, under Chapter IV of the public land act, is not entitled to make a homestead entry.

4. *Area of homestead and shape of tract.*—A homestead can not exceed 16 hectares in area, but any amount less than that may be entered.

Whenever land is sought to be acquired as a homestead which has been surveyed by the government under some plan for subdividing the public lands, such land must be taken by legal subdivisions. In case an entry is made on unsurveyed land, the tract entered must be in a single body, as nearly as practicable rectangular in shape, and not more than 800 meters in length.

5. *Procedure in making entry.*—An approved form on which to make an application for a homestead entry may be obtained by addressing the bureau of public lands, Manila, P. I. In executing the application care should be taken by the applicant to fill up all the blank spaces in the form. The best possible description as to the location and boundaries of the tract, without making a survey, should be given, and the corners of the tract should be carefully marked on the ground by using stones or stakes. The application should be filed with the chief of the bureau of public lands, Manila, P. I.

6. *Residence and cultivation.*—The applicant must continuously *reside* upon and *cultivate* the land for a period of five years from the date of the filing of his application. Failure to reside on the land for a period of six months will constitute an abandonment of the entry and subject it to cancellation.

7. *Contests and adverse claims.*—Any person, whether qualified to make a homestead entry or not, if he knows of any reason why an application should not be approved, or of any reason why an entry in which the application has been approved should be canceled, may initiate a contest against the applicant or entryman by filing an affidavit with the chief of the bureau of public lands, wherein is set out the reasons why the application should be denied or the entry canceled. Upon the termination of a contest, if the application has been disapproved or the entry canceled, the person initiating the contest, if he is qualified under the law to enter a homestead has a preference right of entry as to the land for sixty days from the date of the final decision on the contest.

8. *Procedure to obtain patent.*—At any time within three years after the expiration of the five years mentioned in paragraph 6, the applicant may submit proof showing that he has complied with the law in the matter of residence on the land and cultivation of same. An approved form on which to make this proof will be furnished by the bureau of public lands. In case the proof is satisfactory a patent will issue.

9. *Heirs of homestead settler.*—If the applicant is a married man, and should die after entry and before patent, his surviving widow, by complying with the requirements of the homestead law as to residence and cultivation, may submit proof of this

fact and obtain the patent in her name. If the applicant be not married, and should die after entry and before patent, such of his heirs as by law could inherit real estate from him, by complying with the above-mentioned requirements of the homestead law, may submit final proof and obtain the patent.

10. *Surveys.*—No homestead will be patented until the land has been surveyed and platted. The survey will be made as soon after the final proofs have been approved as it is possible for the surveyors to take up the work. This survey will be at the cost of the government.

11. *Fees.*—A fee of ₱10 is required to be paid to the officer with whom the application is filed at the date of filing the same. At the time of submitting final proof (see par. 8) the entryman must pay ₱10, as final fee, to the officer with whom the final proof is filed. These are the only fees that the government requires to be paid under the homestead law.

12. *Miscellaneous.*—Attention is invited to the fact that section 77 of the public land act prescribes a penalty for the presentation of false proof or affidavits in connection with applications or claims respecting public lands.

No land acquired as a homestead may be sold, by judgment of a court or otherwise, to satisfy any debt which may have been contracted by the applicant or patentee prior to the date of the patent therefor. (Sec. 4, act No. 926.)

Necessary forms to be used in obtaining a homestead may be had by addressing the bureau of public lands.

WILL M. TIPTON,
Chief Bureau of Public Lands.

Approved, November 7, 1904:
DEAN C. WORCESTER, *Secretary of the Interior.*

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